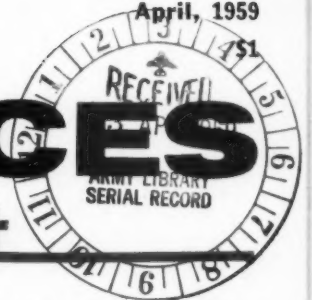


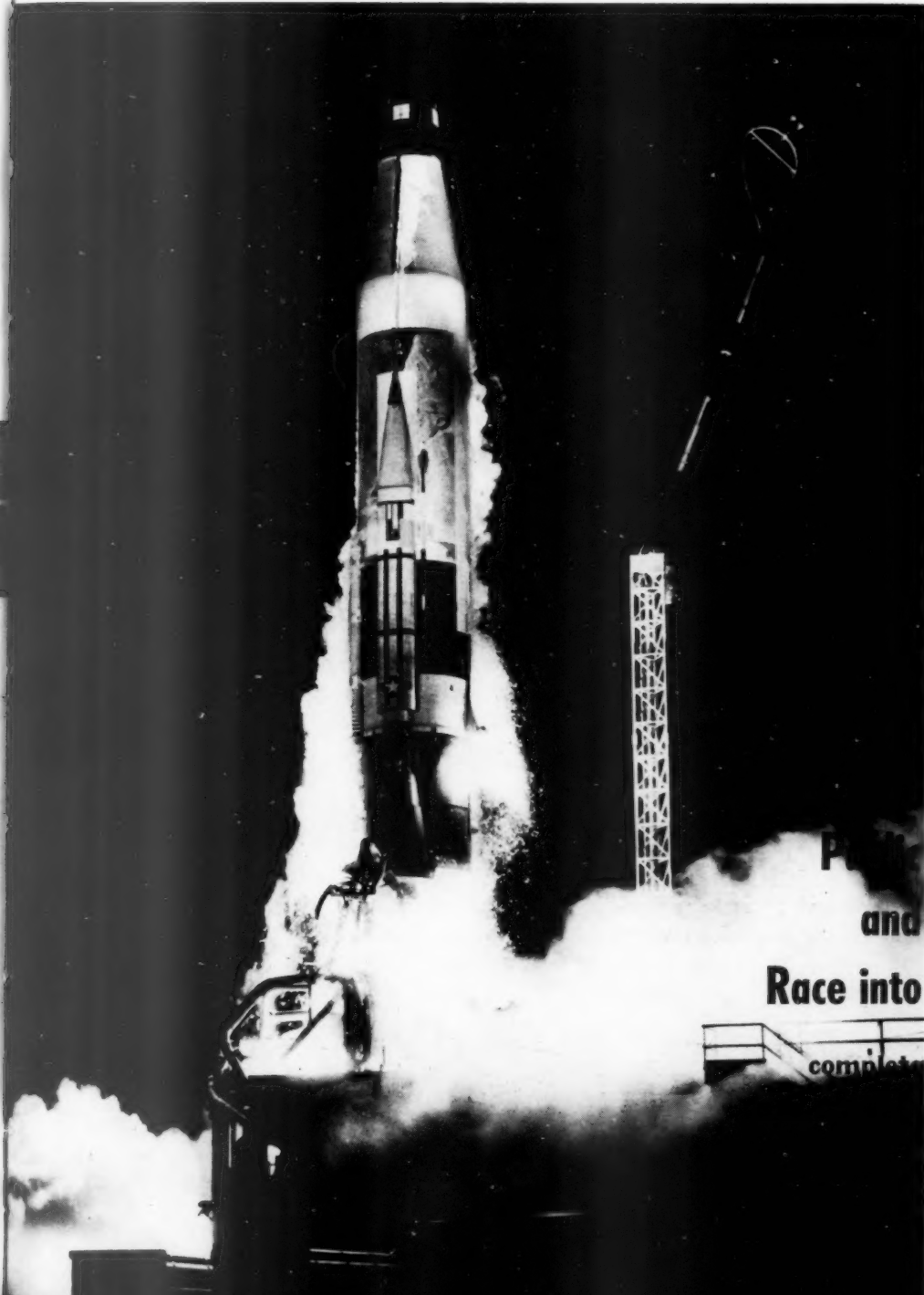
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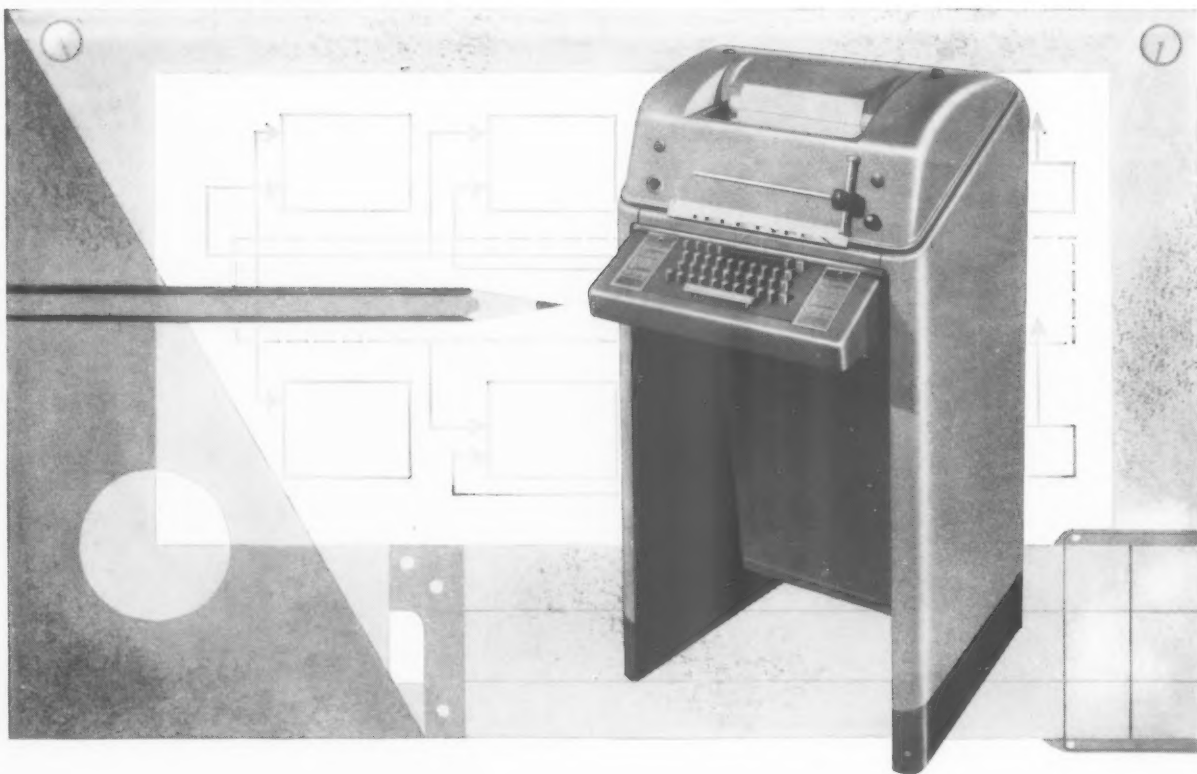


ARMED FORCES management

PUBLISHED FOR THE ARMY, NAVY, AIR FORCE, COAST GUARD AND MARINE CORPS



**Public Fears
and the
Race into Space ... p. 12**
complete contents ... p. 3



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sponsored jointly by the Advanced Research Projects Agency, Department of Defense and the Army Ordnance Command. A scientific staff—most of them RCA personnel—will operate the equipment and report on missile performance from descent from space to final plunge, the data to be shared by all branches of the armed services.



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ARMED FORCES management

PUBLISHED FOR THE ARMY, NAVY, AIR FORCE, COAST GUARD AND MARINE CORPS

APRIL, 1959

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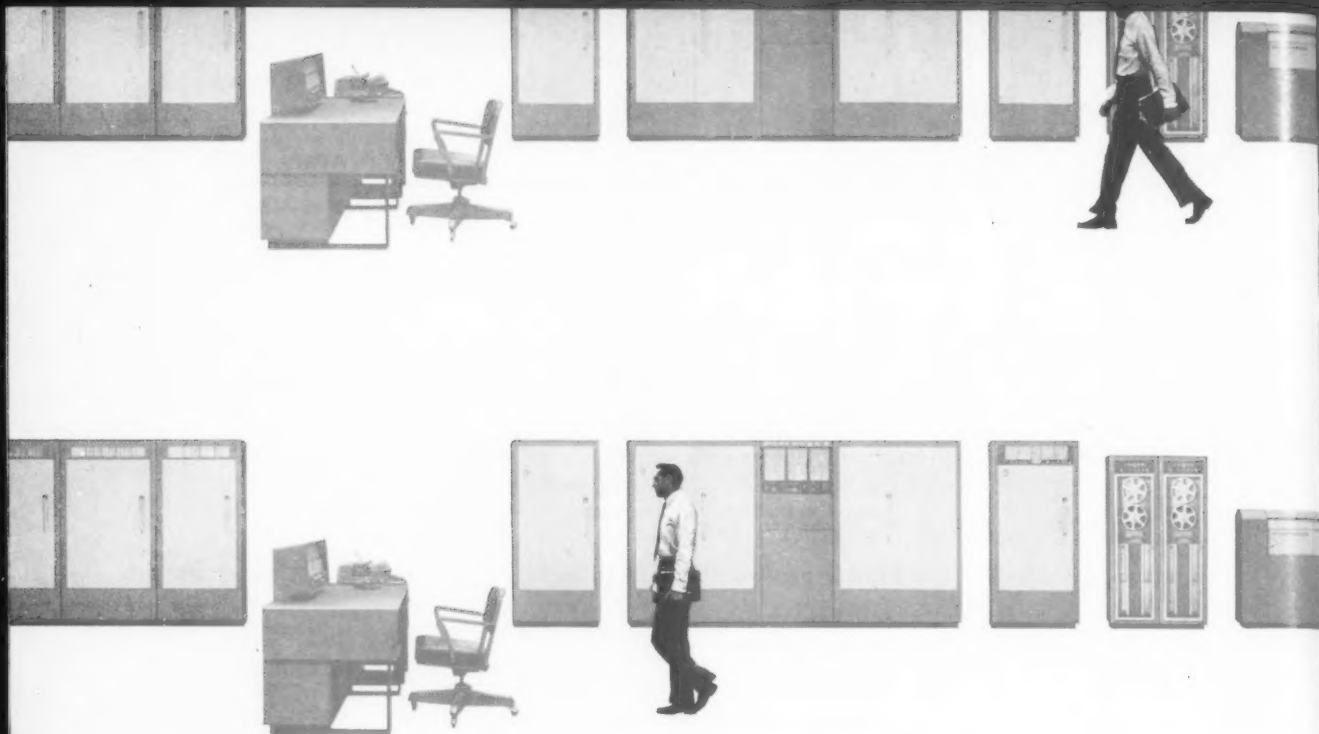
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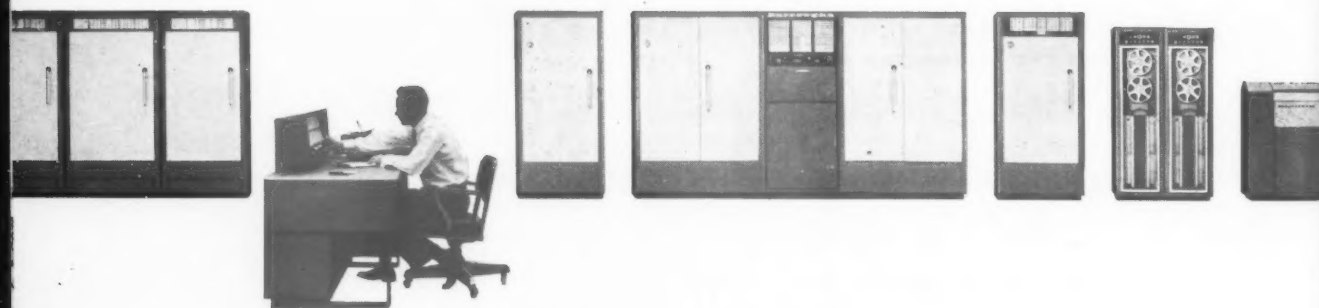
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Why Navy is Reorganizing . . . How Workers Get the Word . . . Missile Logistics: Birthplace of Tomorrow's Air Force Supply System?

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APRIL 1959

EDITORIAL

Second-Guessing the Experts

MILITARY experts are growing more and more convinced that there is a big vacuum between the Pentagon and the American people. Unfortunately, this has weakened the public's faith in its own experts, too often created hassles which had no business happening. Just as unfortunate: this "monkey on the military back" is, to a fair-sized extent, the Pentagon's own fault.

Latest evidence is the current public outcry over the presumed "missile gap" of 1961-65. The published figures have not always been consistent, but the "gap" in intercontinental ballistic missiles, during that period, is supposed to reach a peak in the neighborhood of three to one (our 200 Atlas and Titan missiles to Russia's 600 ICBMs).

The fear of the fainthearted: "That's not enough. Let's buy 200 more." The cost: a "paltry" (their adjective) \$2.5 billion—plus, presumably, more launch sites. Fortunately, the Air Force Air Staff (let alone SecDef) is not buying the idea and probably won't. Said AF Vice Chief of Staff Curtis LeMay, "I don't want to hear that we should have more ICBMs from the guy who's making them. I want to hear it from the boys who will be using them." And SAC Commander Power has not voted for more "obsolescent" Atlases.

Probably the reason for all this diversionary clatter is a peculiar estimate of when second generation missiles Polaris and Minuteman will be available in quantity. Said no less a distinguished publication than *Life* magazine, "Neither Polaris nor Minuteman can be counted on as a significant addition to the national arsenal until well into 1964." Answered an informed Navy spokesman, "This is categorical nonsense. Polaris and the submarine that launches it will be operational in the fleet next year. By then, we'll be able to pound out as many of these things as they want to give us money for."

The point is, say top-level DOD planners, "If the Monday morning quarterbacks want more missile hardware, let's buy Polaris and Minuteman, next year's missile model, not last year's used car." In any event, the defeatest psychosis running rampant through the country is badly in need of a good couch treatment. Said Army Brig. Gen. A. W. Betts, military executive assistant to the guided missiles director, "Our top-level military judgment is being quietly swept under the rug in favor of a popular political catch phrase, 'Let's close the missile gap,' I might say parenthetically, a non-existent missile gap."

Pointing to a six-inch-thick, loose leaf manual, another general growled, "That is a study of one weapon system, compiled by military experts. We have one of those for every missile built or building. Yet some amateurs with a loud mouthpiece can read a couple news stories and, off the top of their hats, decide we're all wet." The answer to that: "We wouldn't do so much second-guessing if we didn't have to guess in the first place."

The grippers' point: the word, once out, nearly always appears as if it had to be pried loose by committee hearings, diatribes and mis-leading editorials. The number of Pentagon fighters willing to handle Washington politics like any other battle, instead of hiding behind some archaic ideas about what is classified information, are few and far between. (The strange anomaly is that when they appear on the scene they invariably rise to the top of the Pentagon heap). In the meantime, all too often, the Pentagon makes its case badly.

The effectiveness of our deterrent strength depends to a very great extent on the Russians knowing just how good it is. Let us hope they have a much better idea of how strong we are than the people do who are paying the Pentagon's bills. If not, the threat of World War III is indeed monstrous.

Bill Borklund

In My Opinion

Comments on CPFF

I appreciate very much . . . the article by Burgess Dempster (Why Research Costs Too Much, March AFM) on research costs.

I think until the Subcommittee's projected hearings have been concluded, it would be presumptuous for me to comment on evidence which may come before us.

I hope you will accept my thanks for bringing this material to my attention and that you will, for the reasons cited, excuse me from commenting beyond saying that I appreciate having received this material.

Rep. F. Edward Hebert

Chairman
Subcommittee for Special Investigations
Committee on Armed Services

WSPO Story Praised

On behalf of Gen. Beverly H. Warren, I would like to convey his appreciation, and that of the people of the Aeronautical Systems Center, for the excellent article on "Weapons System Procurement" which appeared in the February issue of your management magazine.

Your detailed analysis of our pre-and post-contract review of the subcontracting structure is a point often overlooked in many publications. We feel that the emphasis accorded this point may tend to clarify a lot of misunderstanding of our surveillance of the subcontracting area.

We hope to see more informative articles about the functions of the Aeronautical Systems Center in future issues of ARMED FORCES MANAGEMENT.

Lt. Col. C. H. Shambeck

Executive Officer
Aeronautical Systems Center
Wright-Patterson, AFB, Ohio

. . . "The WSPO Concept: Space Age Procurement," that appeared in the February issue of ARMED FORCES MANAGEMENT was, indeed, a most timely, concise and pointedly precise discussion of WSPO operations and problems. In fact, the article was so well received by several of the project offices that additional distribution to individual members of WSPO's is desired.

. . . May I take this opportunity to express appreciation for the excellent editorial standards and policies maintained by you and your staff. Your efforts are attested by the interest

shown and the many favorable comments I receive from personnel under my supervision who read your magazine.

Nate Silverston

Deputy Chief, Tanker WSPO
Directorate of Strategic Systems, AMC

Promotion Story 'Useful'

The feature, "How Officers Get Promoted" by Fred Hamlin (in) December 1958 issue of ARMED FORCES MANAGEMENT, is very enlightening and timely.

I am interested in obtaining . . . copies of this article for dissemination to officers within Air Rescue Service . . . This material will be useful in our personnel quality control program.

Col. W. L. Gibson

DCS/Personnel
Headquarters, Air Rescue Service
USAF

Bouquets on ASW Story

. . . I consider "Can We Stop the Silent Assassin?" one of the most accurate and intelligently composed [articles] I have seen on such a subject. The quotes he gave were very well selected, and the sequence of his presentations of the material about the Navy and General Dynamics, and about Thach, Wenzel and myself, was especially good. We are delighted that ARMED FORCES MANAGEMENT carried this article at this particular time . . . We are making wide distribution of it within our divisions and Corporate staff, including the ASW planning and Coordinating Committee, of course.

L. B. Richardson

Senior V. P.-Engineering
General Dynamics Corporation

I received . . . "Can We Stop the Silent Assassin?" written by Bill Borklund. It was a well-written article which covered the number one threat of the Soviet submarine force.

A Seapower Symposium on Anti-Submarine Warfare, sponsored by the Navy League, served to focus attention on this very difficult problem confronting our Navy today. VAdm. Pirie, Deputy Chief of Naval Operations for Air, and RAdm. Thach, Commander of the famed Task Group ALFA, both gave an excellent account of the importance of air in the role of ASW. Adm. Pirie particularly emphasized the part that industry is playing in solving the ASW problem.

To Adm. Thach's ten most urgent needs for anti-submarine defense must be added one more requirement as follows: "The prosecution of a high-level intensive training program to insure a thorough understanding by

all personnel of basic and advanced ASW tactics of their individual units and coordinated inner type tactics." Trained personnel are one of the fundamental keys of ASW readiness. In the Atlantic this training is now being accomplished by Task Groups ALFA, BRAVO and CHARLIE. The corollary requirement is to furnish these men with reliable equipment that can do the job.

Your Article in ARMED FORCES MANAGEMENT is a timely one. This emphasis and focus of attention on the Soviet submarine threat will assist in the search for its solution. I will be most happy to discuss ASW further anytime to suit your convenience. Thank you for your thoughtfulness . . .

Capt. G. D. Chesquire, USN
Head, Air Anti-Submarine Warfare
Office of the Chief of Naval Operations

Bogeyman Letter

I read with considerable interest the article in the February issue of ARMED FORCES MANAGEMENT in which a reader commented on "Civil Service: The Management Bogeyman." The arguments expressed in this article have considerable validity. I do not agree, however, that they are wholly true, and I believe that those portions which are true are due, not to "civil service" *per se*, but to the way in which we use the tools civil service has given us. These tools have been sometimes pointed away from an incentive to economy, and it is understandable human nature for an individual to hesitate to institute economies which may lessen his salary and prestige.

In my last command at the Naval Supply Center at Pearl Harbor, I instituted economies resulting in a reduction of personnel and expenditures of about twenty percent, at the same time improving efficiency. I don't mind stating very frankly that if these economies had resulted in a reduction in grade to me, my enthusiasm for effecting these economies would have been considerably dampened. If, in Civil Service, standards for classification and pay are based significantly on the number of people supervised, the most important ingredient of incentive to economize is lost.

Fortunately, in recent years, considerable improvements have been made in classification standards. In fact, in December 1955 the Navy Office of Industrial Relations issued its Notice 12156, emphasizing the fact that numbers supervised do not necessarily affect the grade of the supervisor. This Notice also requested all naval activities to give the matter wide dissemination by means of station

ARMED FORCES MANAGEMENT

newspapers, bulletin boards and so on. That there is a necessity for further education on this subject is evidenced by the article on "Civil Service" in your February issue. It may be that further improvement in Civil Service standards in respect to management responsibilities—other than supervision—is desirable. It may also be that some of the Civil Service standards are not being properly applied. Certainly there is need for more widespread knowledge of the fact that classification standards are passed on the importance and complexity of the position, rather than primarily on the number of helpers.

There is another field in which I think we have not properly utilized the tools given us, and that is in the field of incentive awards. The monetary value of these incentive awards is rather small, but the recognition attending an award for superior accomplishment cannot be priced out in dollars and cents to the individual. I believe we should place more emphasis on these incentive awards, particularly in the case of those supervisors who are able to improve management practices and reduce personnel and expenditures.

Carlisle once said "An educated man stands in the midst of a vast arsenal and storehouse, filled with all the weapons and engines which man's ingenuity has been able to devise throughout past ages."

Let's use some of those "weapons and engines"!

RAdm. Joel D. Parks

Commanding Officer
U. S. Naval Supply Depot
San Diego, Calif.

Regarding the article in your February issue, "Civil Service: The Management Bogeyman," the author has hit the nail on the head. I admire him for having the courage to write about conditions as they really are. I know—I have been in Civil Service for almost 20 years . . .

A Reader

. . . If Mr. Stonewall's indictment of a group of people was not accurate, then it should not have been printed.

Joseph Sefekar

Hicksville, N.Y.

There's a large-size difference between being not quite and being completely in—. . . Ed.

. . . While granting that some of the provisions of the Civil Service system restrict the freedom of operation of managers (and thereby reduce the

(Continued page 46)

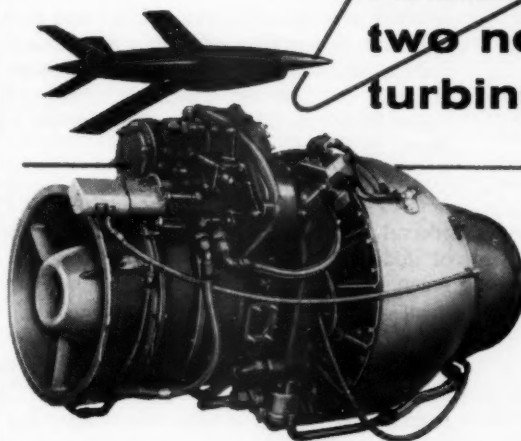
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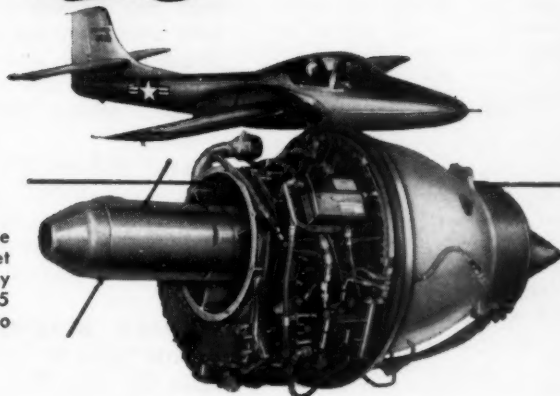
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J69-T-29A

1,700 lb.-thrust model for drone applications. The new engine has 60% more thrust with only a 6% increase in weight. It is presently powering the Ryan Q-2C target drone which recently underwent successful flight tests.



J69-T-25

Latest power plant for the Air Force T-37A twin-jet trainer manufactured by Cessna, the J69-T-25 has increased thrust to 1,025 lbs.

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Washington Background

CONVICTION IS GROWING AMONG NAVY ANTI-SUBMARINE warfare people that the only way to solve the monstrous ASW problem in time is through a special projects office. In spite of many voiced objections to such a move, consensus of the crusaders is: "If we want to solve this problem badly enough, we'll set up a horizontal group with command authority. If we don't want to, we'll keep on the way we are now."

NAVY IS SLOWLY BUT SURELY CONCLUDING ITS BUREAU SYSTEM of organization needs some drastic changing—if not abolition. Idea was favorite study topic of soon-to-be Navy Secretary Franke's reorganization committee, resulted in proposal to weld BuOrd and BuAir into a new Bureau of Weapons. List of admirals favoring change is impressive. Because of success on nuclear submarine and Polaris, Air Force advances under weapon system concept, this "Change the Bureaus" theme is rapidly gaining support, has already been mentioned in connection with anti-submarine warfare headache, atomic logistics plans (both described in this issue).

OUT-COME OF HEBERT COMMITTEE'S investigation will be key to several bills on Defense procurement practices. Both House and Senate now, as of mid-March, have a variety of proposed laws in the shop, some of which give green light to negotiated buying, others insisting on strictly competitive procurement—"wherever possible."

WASHINGTON IS AWASH WITH DEBATE about the need for more coordination in space study. Little realized: National Aeronautic and Space Administration, in an amazingly short time, has emerged has the real power in this field; new Defense Director of Research and Engineering has evolved a pretty solid conceptual approach to his job—which includes control of Advanced Research Projects Agency. (See p. 14, this issue) Debate may turn out to be academic. In meantime, most repeated argument is "we need a single agency for both military and civilian study."

NEW SYMINGTON SUBCOMMITTEE, SET UP IN MARCH to investigate "waste and rivalry" in U.S. military and civilian space programs, plans to move "swiftly into public hearings." Symington has voiced concern over "sprawling and tangled jurisdiction of space programs, duplication, and funds . . . going down the drain."

SMALL BUSINESS' "FAIR" SHARE OF DEFENSE CONTRACTS, a favorite theme of Congressmen looking for ways to keep busy, is on the docket again this year. Producer of the 1959 play is veteran Democrat A. J. Multer of New York, chairman of a special House subcommittee on small business and government procurement. Play's opening day not set but will be "soon." Defense department again cast as villain, small business as the "exploited little guy." This year's subjects include use of qualified bidders' lists, negotiated procurement, bidding procedures, fair and equitable treatment. "So far," said one Defense small business official, "it looks like it'll be last year's porridge warmed over."

PENTAGON PERSONNEL PEOPLE ARE CONCERNED OVER rumblings at Defense assistant secretary level, rumors that wholesale exodus of these key civilians may start by year-end. There are three reasons rumors may be true: McElroy's leaving, just-around-the-corner election which will probably see their ouster anyway, all the new faces coming in at the military level in mid-year. Pentagon fear: a drastic sag in organization momentum—which could run as much as two years because of some of the lame-duck aspects. One much discussed (informally, so far) solution: give top-level career civil servants a crack at some of the openings.

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Weapon Systems Probe Scheduled for April

April 6 will see the beginning of the long-awaited Hebert probe into the weapons system concept. First witnesses in the "long overdue" hearings will be major military weapons system manufacturers.

Objects of the investigation will be to find out just what weapons system means. According to Hebert, some critics have called it a "blank check," while others have reported the concept to be "very vague."

Hebert said no questionnaires will be sent to manufacturers, as was the case during similar 1956 investigations. Under scrutiny will be financial arrangements, facilities, performance rates, termination costs and cost allowances—which sometimes vary between firms.

The probe points up the chance of a change in the Armed Service Procurement Regulations, but this will necessarily depend on the committees findings.

AF Repairs Cost More Than New Vehicles Do

Air Force has been spending more to repair old cars, trucks and other ground vehicles than it would cost for them to buy new equipment, Defense Department has admitted to Congress. The reason, says DOD, lies in budgetary limitations.

DOD told the House/Senate Economic Committee that maintenance charges are not charged against the AF budget, but the new vehicles would be. These facts came out in answer to a GAO charge that the Air Force was overspending and overstocking supplies.

DOD explained that "the forced retention of certain vehicles beyond the point of economical return . . . required expenditure of maintenance funds beyond that which would have been required if adequate replacement vehicles were furnished . . . This resulted from efforts to remain within established budgetary limitations as well as program fluctuations during this period."

Navy Overhaul Set, Will Begin in May

The first step in what may be a complete reorganization of the business end of the Navy has created a new Bureau of Naval Weapons, combining the former Bureaus of Aeronautics and Ordnance. In another major

change, Navy has created a Deputy Chief of Naval Operations for Development.

ARMED FORCES MANAGEMENT will carry a complete analysis of the changes in its May issue, when the first of the changes are slated to occur. Aim of the reorganization is to prepare the Navy structure for operations in a missile/nuclear age.

Under Navy Secretary William B. Franke—who headed the six-month study from which the reorganization evolved—said the final changes would take about a year to be completed, and possibly four years until they are fully effective. Franke is scheduled to take over as Secretary of the Navy this June.

Congressional action will be necessary for changes which would eliminate the high degree of personnel specialization now used in the Navy. Franke also said the Navy wants four assistant secretaries, instead of the three now authorized. This change will also require Congressional approval.

As a result of the proposed changes, RAdm. J. T. Hayward will be promoted to VAdm. to fill the DCNO-Development slot. His office will have responsibility for all Navy research, engineering, test and evaluation programs.

Quarles Tells Congress Why IDA was Set Up

Institute of Defense Analyses was formed to provide Defense Department officials with "technical advice" of the same caliber that the services were getting, according to Deputy Defense Secretary Donald Quarles. Quarles testified before the House Military Operations Subcommittee, which is investigating management of U.S. missile programs.

Quarles told the House group that IDA officials do not select contractors for the jobs they do. Their role, he said, is limited to technical advice, and he said that IDA is strictly non-profit.

Quarles testified that the original contract to form IDA was let to Massachusetts Institute of Technology in 1955. Quarles said "IDA employs competent people to the best advantage of the government."

Quizzed on the Air Force relation to Thompson-Ramo-Wooldridge Space Technology Laboratories, Quarles said it was "an effective arrangement" to advance the program, but not necessarily the way to handle every project that comes up. He also said that neither termination nor broadening of the STL/AF arrangement were foreseeable.

Betts Sees No 'Gap,' Scores Defense Critics

U.S. Strategic attack forces are "not only currently adequate, but are scheduled to remain so," Brig. Gen. A. W. Betts, military executive assistant to the director of guided missiles, Department of Defense, told the National Security Industrial Association in New York recently. Citing JCS endorsement of our present defense strength, he said the rumor that a balanced budget stands between us and ICBM parity is created by well-meaning but uninformed "good people."

In an earlier interview with ARMED FORCES MANAGEMENT, Gen. Betts stressed the huge amounts of study that go into each missile decision, and said that it is impossible to voice opinions on missile programs without this background. "Everybody has become a defense expert lately," he said.

"Our top level military judgment is being quietly swept under the rug in favor of a popular political catch phrase 'Let's close the missile gap'—I might say parenthetically a non-existent missile gap."

Lockheed, Convair Criticized by GAO

Failure by Lockheed Aircraft Corp. and Convair Division of General Dynamics to press for detailed cost information on landing gear subcontracts has resulted in profits as high as 29% for the Menasco Mfg. Co., according to recent charges by General Accounting Office.

In their report to Congress, GAO charged that Convair and Lockheed, as prime contractors, accepted Menasco price estimates without the figures to back them up. Further, "In the absence of such information, the proposed price could not be evaluated properly and there was no assurance that the prices were reasonable."

Sneak Attack Unlikely, McElroy Tells Congress

Because of the great number of targets that the Russians would have to hit, and because it would take four to six missiles to insure a kill on any given target, it is highly unlikely that the Russians will launch a surprise attack on this country, according to Defense Secretary Neil McElroy.

Further, McElroy said, it would be extremely difficult for the Russians to make the necessary preparations for such an attack without being detected. With the amount of warning the U.S. would have, he added, it would be conceivable for the U.S. to have a chance at the first shot.

Lockheed's Hercules takes U.S. based troops Any place on Earth in 1½ days

The Jet Age's first strategic/tactical transport, the new Lockheed C-130B HERCULES, is the only U. S. Air Force plane designed specifically to airlift battle-ready troops, equipment, and supplies from the U. S. to any area on earth in 36 hours or less—then parachute them into battle zones or land with them on short, rough fields, sand, snow or ice.

The C-130B HERCULES is a huskier, more powerful, longer range version of the C-130A HERCULES—which in two years of world-wide service with the Air Force has become the unchallenged Champion of the U. S. Strategic Airlift.

Now coming off production lines at Lockheed's Georgia Division, the new C-130B HERCULES will soon enter service with the U. S. Air Force's Tactical Air Command.



Takeoffs from deep sand averaged only 1500 feet in a C130A at 110,000 pounds gross weight. With same load it landed on sand and stopped in less than 950 feet.



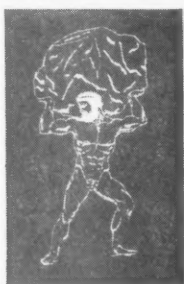
Landing on frozen lake, "Ski-130" (weighing 62 tons gross) stops in 1200 feet. Taking off from same lake, this ski-fitted Airlift Champion was airborne in 2100 feet.



20 tons of pallet-loaded cargo can be winched in or out of the C-130 in 40 seconds. HERCULES can land, unload 20 tons, reload 20 tons, take off in 20 minutes—saving 2½ hours.



The C-130 HERCULES transports 92 battle-ready troops, or 64 fully-equipped paratroops — and holds the world record for the heaviest parachute-extracted drop: 30,370 pounds.



C-130B Hercules Specifications: Wingspan, 132.6 ft. Length, 97.7 ft. Cargo volume, 4300 cubic ft. Gross weight, 135,000 lbs. Engines, 4 GM-Allison 4050 eshp Prop-jets.

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NUCLEAR REACTOR DESIGN & DEVELOPMENT • GROUND SUPPORT EQUIPMENT • WORLD-WIDE AIRCRAFT MAINTENANCE

Public Fears And the Race into Space

A top U.S. space scientist comments on the "psychology of failure," and analyzes the harmful effects of an over-eager public on American missile progress . . .

by Dr. W. H. Pickering

Director, Jet Propulsion Laboratory
California Institute of Technology

JUST over a year ago the country was still recovering from the shock of seeing the Russians place two satellites in orbit barely a month apart. There was a universal—almost hysterical—reaction, demanding that we act quickly to counter this cold war victory.

Now, a year later, is a good time to review what has been done to catch up with Russian accomplishments in guided missile and space vehicle fields.

First, let us look at what we know about Russian achievements. They have placed three satellites in orbit, each one heavier and larger than the preceding. The last satellite is said to have a useful payload in orbit of about 3000 pounds. Unfortunately we do not know how many attempts it took to place these three objects in orbit, nor how many attempts may have failed to place objects in other orbits.

As far as the Russian intercontinental ballistic missile is concerned, we know much less. The Russians announced last summer, just before their satellite firing, that they had completed two successful ICBM tests. Since then, there have been various rumors, but I do not believe there have been further official announcements.

It is interesting to see what clues the Russian satellite program can give us on the guidance accuracy of Russian long-range missiles. We do not know precisely what objectives the Russians wanted with their satellites orbits, but because of the similarity of the three orbits, it is tempting to assume they were meant to be identical, and use their differences to measure guidance accuracy. The three satellites were in orbits inclined to the equator at angles of 65, 65.3 and 65 degrees. All three were thus launched quite accurately in the same azimuth direction. The perigee altitudes of the three were 141, 139 and 150 miles. This means the injection altitude into orbit was closely controlled and the direction of the velocity vector at injection was closely horizontal. The guidance accuracy of the satellite launching system is therefore remarkably good. Since the injection point may be nearly 1000 miles from launch, this means a demonstrated ability to hit a point in space roughly 1000 miles away, with a probable error of about 5 miles.

The other guidance parameter to be considered is velocity. Injection velocity is measured by apogee altitude. These were 588, 1032 and 1168 miles. This corresponds to about 5% change in velocity. I do not believe this is an indication of the velocity accuracy which the Russians could attain with their guided missiles, but is rather an incidental to the particular scientific programs associated

with the three satellites. As a matter of fact, the satellite with the highest apogee—and therefore the greatest launching velocity—is also the satellite with the heaviest payload.

As an indication of comparable figures for the U.S. program, I might note in passing that the three Explorers in orbit have perigee altitudes of 227, 124, and 160 miles, a much greater difference than the three Russian satellites. This sort of evidence all indicates that the Russians have considerable competence in the field of long range, large guided missiles.

After the shock of the Sputniks, I think it is obvious to say that the missile and satellite programs in this country received tremendous impetus. Perhaps because of the way in which these programs developed, the impetus given did not result in the most efficient program for the nation as a whole, but we can say that a tremendous effort was put forth to develop our missiles and satellites as rapidly as possible. On the surface it looks like considerable achievement, but I would like to raise a few questions.

First, there is the obvious comparison between the Russian and American satellites, namely size. All of the objects we have placed in orbit, instrument packages and rocket shells, could probably have been placed aboard the last Russian satellite and hardly have been noticed. What does this mean? I do not believe that the Russians have developed any startling new fuel, or any fundamental new principle of rocket propulsion, and so I can only conclude that their launching rockets have been considerably larger and more powerful than any we have used. We can say the weight of a satellite launching rocket at take-off is somewhere between 100 and 1,000 times the weight of the useful payload placed in orbit. In fact, Explorer was not even that efficient. You can use your own guesses as to the sophistication of the Russian launching system, but no matter what figure you use, you must conclude that the missile which launched Sputnik III was at least as big as our Atlas.

This only shows that the Russians are ahead of us in guided missile art, but the important thing is this: Are we showing any signs of catching up?

To this I can only answer a qualified Yes. We are certainly further ahead than a year ago, but I do not know what progress the Russians are making. Also, when I look behind all the flag waving at Cape Canaveral, I am disturbed at some of the things which I see happening.

The thing which disturbs me most, I believe, is the psychology of failure which we seem to be developing. Every time I pick up a paper or a magazine I see either an excuse for why the last test failed, or a guess at why



the next test is going to fail. I was shocked to see in a recent AIR FORCE magazine that the very first article in Volume I, Number 1 of the *Space Digest* was entitled "Pioneer, the Most Glorious Failure in History." Now, since when have we as a nation had to justify in this way our errors in engineering design, or systems analysis, or manufacturing quality control, or whatever it was? Surely we have come to a pretty pass if we advertise our failures in this way and if we go on expecting failures.

It is certainly ironical to see this technological, successful nation expecting to fail in its most advanced technological developments. There have been times in history when a failure has been acclaimed as a glorious achievement, but these are achievements of the human spirit against insurmountable obstacles. Man against Newton's laws is not in this category.

Of course we should learn from our failures in the physical sciences. A few months ago my Laboratory launched a satellite which failed. It failed because of insufficient engineering analysis and test of a condition which was encountered in flight. This was not a glorious failure. It was a hard lesson and it applied to future work. It was just another satellite firing so the publicity problem was not serious, but I am concerned with the "better luck next time" attitude I find even among many of my personnel working on that program. Such an attitude is inevitably engendered when there is widespread acceptance of the notion that, to quote a recent publication—"a new axiom, unique to the Space Age, has come into the language,—nothing succeeds like failure." I thought we were engineers and scientists, not magicians or astrologers dealing in sorcery and fortune telling.

Since this is a new phenomenon in our technological development, it would appear appropriate to ask how we go into this situation. I think the key is the Vanguard failure last December. Coming so soon after the Sputniks, the public outcry for an explanation was inevitable. The explanation, quite rightly, had to emphasize the nature of developmental testing and the probability of failure in certain tests. The difficulty is that the same song has been played so often now, that it has become a part of missile folklore, or, as I just quoted, an axiom for the Space Age.

I do not believe any such axiom is necessary. The point has been made that a missile is a very complicated device. True, but an airplane has many more parts than a missile and I am certainly glad that airplanes were not developed in an atmosphere of expected failures. The problem comes back to the fact that we have tried to move our developments ahead faster than engineering experience or the state-of-the-art dictated as prudent. We have tried to run before we can walk. The impetus for this came from an estimate of military requirements. It is not for me to judge the reality and urgency of those requirements. All I can say is that I hope those who made the decision realized the gamble which was taken on success, and the costs both fiscal and psychological that resulted from such an accelerated program.

The Future

What is past cannot be changed, and my concern is for the future. Let me make a plea to those who plan programs to be more realistic in their scheduling and in estimating expected progress. If this can be done, technical staffs will not have to be continually in a crash program. Engineering analysis and testing can be properly conducted. Pre-flight testing and reliability programs can be carried out.

It seems to me it is high time to quit reacting to every Russian action. We are in a race with Russia of course, but we will not win that race if we become so frantically

excited that we go stumbling down the track. If we set our own pace we will produce the best results.

Better flight test results require a better understanding of the entire system problem. Thorough engineering analysis and pre-flight testing is called for. One essential ingredient which cannot be obtained overnight—experience—is no longer the rare commodity it was a year ago. Consequently we should expect our performance to begin to show significant improvement.

It seems to me that the key to obtaining a real improvement is recognition by both Government and industry that missile design is an engineering problem and that failure can only mean one of two things—failure to understand the problem or poor engineering design. In either case the lesson to be learned from failure is to review the problem in an analytical manner, then apply the analysis results.

I think at one time or another we have all paid lip service to such things as reliability, quality control, sound engineering test programs. If we really believe in all of these things, there should be no question of a psychology of failure. We might experience failures, but we would plan programs which would bring success.

Public Fears

Perhaps the publicity associated with these programs has been the real cause of the trouble. We seem to be trapped trying to explain individual events to a public which cannot have any real appreciation for engineering development problems. What is needed for public understanding is an appreciation for a complete program, an understanding that the overall flight test program will integrate into success.

I hope that when the Pacific Missile Range is operative the fact that launching sites will be practically impossible to see from points off the base, will allow this whole publicity problem to be handled in a much more satisfactory manner. I believe that the operations at the White Sands-Holloman range are conducted in a much sounder engineering atmosphere, partly because of this difference in public attention.

The problem is not only that of the relations between the missile programs and the public—of equal importance is the relation between the technical teams and the public. While a program is new and glamorous, a certain amount of failure is acceptable. But the glamour soon wears off and the morale of the technical team will rapidly deteriorate unless it is working on a successful program. Again let me quote from my own experience with the Explorer program. I am sure many of the firing crew were quite disheartened to see how fickle the public had become when Explorer 4 was fired with hardly a ripple of interest.

Again let me say that the essential feature is not a program with no failures, but a program conducted in such a way that success is expected, and it is clear that the program is being conducted with test objectives consistent with engineering knowledge.

This is a critical period, particularly in the space program. The cost per experiment is increasing rapidly. The public and the Congress will not accept a psychology of failure much longer. The prestige of the Nation will suffer if it appears that a success is only a lucky fluke. We need sound engineering, reasonable flight test objectives and a careful evaluation of the real national program needs.

Our engineers and firing crews are gaining experience. We can do the job right. If we accept the psychology of failure then we will never even attain mediocrity, let alone approach perfection. The USSR will continue to lead us easily. We must set success as our goal and be content with nothing less. Only then will we catch and surpass Soviet Russia in this vital area.

The Horizontal Approach To Defense Research

With a new Director of Defense Research and Engineering, there has come a new concept in R&E Management. The aim is for across-the-board coverage—with no duplication. Here is the story . . .

by Fred Hamlin

"MOST of what we are doing is not shooting things up into the air. An important part of our job is to see that programs not as glamorous receive sufficient planning. Space covers only a small part of our total work. We must make sure that no important projects are overlooked—and that none are left out because they are only half important to two services."

The speaker is Dr. Herbert York, Director of Defense Research and Engineering. From a defense standpoint, how well his statement is fulfilled in the coming months could spell the difference between national survival and defeat.

Hanging over the Doctor's office door is a spear—labeled "World War IV Weapon." The spear is an indication of the thoroughness with which Dr. York intends to do his job. A sampling of the projects over which the new R&D office will exercise supervision includes: missiles (says York, "there will be more of them just as sure as death and taxes"); aircraft, including such advanced systems as the B-70 and the F-108; vertical and short take off and landing aircraft; ship propulsion, both nuclear and conventional; ground transportation; improved ammunition; materials; and food and blood preservation.

While the former Assistant Secretary for Research and Engineering recommended approval, modification, disapproval or initiation of research projects in the Department of Defense to the Secretary, these decisions now rest with the Director's office. While the

services can go over the Director's head to the Defense Secretary, it is expected that this will be the exception rather than the rule, and if the original decision was correct, there would be no change.

Dr. York admits that "there are too many projects for us to be directly involved in all of them," but he adds that "while we don't have any projects of our own, we work directly with all those that are especially critical. At one time or another during the year, of course, we come in contact with all of them."

To coordinate the defense research efforts of three military services and the Advanced Research Projects Agency is a huge job. The basic problem is summed up by RAdm. John E. Clark, Deputy Director of the Advanced Research Projects agency: "(Dr. York) wants to make all of the services happy, but of course that's impossible. On the other hand, he's making a good stab at it."

One of the ways in which York is making a "good stab" at his new job is by creating six Operational Systems Offices, to be under Assistants to the Director. In the past, the offices immediately under the Assistant Secretary for R&E were concerned with technical aspects of the research business, as their names indicated. They worked in such areas as Aeronautics, Electronics, Maintenance Engineering, Human Sciences and Atomic-Biological-Chemical Warfare.

In addition to these will be the new Assistants to the Director. Their

offices will treat each individual means of problem solving—Electronics or Aeronautics—in relation to the overall problems with which the overall Defense research program is faced.

The new offices will cover the following areas: (1) Air Defense, (2) Tactical Weapons, (3) Strategic Weapons, (4) Communications, (5) Undersea Warfare, and (6) Special Projects. Their job will be to study all specific projects in DOD for possible application to the area covered by the Operational Systems.

"We must look at SAGE, for instance, not as just a piece of electronics, but as part of the overall Air Defense System. It must fit in the overall Air Defense System."

The aim is to prevent duplication of effort and to identify any gaps that may exist in the overall programs. ARPA's Discoverer project is, under the new system, considered first as a means of space communications and second as a part of the overall Defense communications picture.

The new offices will serve as a step towards greater centralization of defense research and engineering. Ideally they will result in a more completely unified program. Besides the obvious advantage of a highly coordinated research effort, there should be marked money and time savings.

Another specific goal that Dr. York has set for himself in his new job is the following: "We are going to see that there is more exploratory work, and that less of that kind of work becomes systems work . . . We have to explore as many areas as possible, but it is difficult to stop exploratory projects. When a contractor carries on extensive exploratory work on one project, he tends to think that his way is the only to solve the problem."

The object here is to keep ahead of the ever-increasing cost of maintaining up to date military forces. If the Operational Systems Offices explore every angle of a given problem, it is most likely that the finally accepted system will be the best there is to offer. By cutting off those projects that do not show as much promise early, the tremendous production costs on complex weapons systems will be avoided—unless the system is the best that there is to offer.

The two existing offices most effected by the organizational change were the Guided Missiles office of William Holaday and the Weapons System Evaluation Group, headed by VAdm. John Sides.

The change for the first of these is summed up simply by York. "Missiles are coming home to us with the rest of the programs." In the words of Brig. Gen. Austin W. Betts, Executive As-

sistant to Guided Missile Director William Holaday, "We cease to be responsible for the research and development aspects of guided missiles. This will cut a lot of the leg and paper work, but we're still going to be in on the hot fights." Gen. Betts explains that "I think that the Secretary feels with hundreds of millions of dollars in each decision (on missiles) he needs staff work to reach his decisions on level of effort."

The question, says Betts, is "How big is the gamble?" on each missile program. The staff in the Guided Missile Office will be reduced roughly by half. But, Gen. Betts points out, on decisions beyond the research and development stage, the factors to be considered are just exactly as complex—and for this reason Holaday's office will take its new form.

The problem which the new organization is trying to overcome stems, according to Gen. Betts, from the fact that "service lines no longer mean anything." Since World War II, he explained, land, sea, and air have ceased to be neat, "permanent packages," and as a result changes have been necessary in the overall planning and thinking at top DOD levels.

In line with the idea of screening research projects before they reach the production stage, the Weapons Systems Evaluation Group will gain importance. Says Dr. York "we will expand the type of work handled by Weapons Systems Evaluation Group, but they will maintain about the same staff." Says Ben Huff, "this is a better organization to do this type of work than we've ever had before."

Appearing before the House Committee on Science and Astronautics, Dr. York had the following to say about the work he would be doing in his new job: "The basic concept of the new position of Director of Defense Research and Engineering was set forth by the President in his message to Congress that accompanied his defense reorganization proposal of last year . . . He said that the new position would replace that of the Assistant Secretary of Defense (Research and Engineering), that the Director would rank immediately after the service secretaries, and that he would have three principle functions: (1) be the principal advisor to the Secretary of Defense on scientific and technical matters; (2) supervise all research and engineering activities in the Department of Defense, including those of the Advanced Research Projects Agency and of the office of the Director of Guided Missiles; and (3) direct research and engineering activities that require central management.

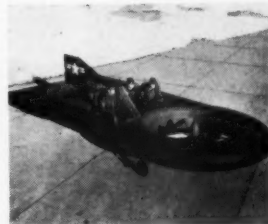
"I believe that the relationship of

my office to other Department of Defense agencies is best understood when viewed in the following context. There are four basic operating agencies in the Department of Defense—Army, Navy, Air Force and the Advanced Research Projects Agency. These agencies all do Research and Engineering either 'in-house' or by contract with outside sources. The function of my office is to supervise and coordinate all Research and Engineering, regardless of what agency undertakes the task or the nature of the task undertaken.

"A fuller explanation of the relationship of my office and the Advanced Research Projects Agency and the Office of the Director of Guided Missiles was made by Secretary McElroy before the House Armed Services Committee earlier this month. He said that 'the Director of Defense Research and Engineering will supervise and coordinate all Department of Defense research and engineering programs.

"We plan to continue the Advanced

There can be no project too unimportant to be overlooked, if the nation is to have the fullest and most economical defense possible. Such items of hardware as VTOL aircraft are by no means as glamorous as space flight and intercontinental missiles, but a well rounded defense is an absolute necessity in both limited and general war. Dr. York's organization of his office reflects his concern with these problems.



Research Projects agency. It will be an operating agency paralleling the research and engineering organizations of the military departments. The Director of this Agency will report to me administratively. However, his research programs will be subject to the supervision and coordination of Dr. York's office just as are those of the military departments.

"Mr. Holaday's job as Director of Guided Missiles has had two quite different aspects. One has been to monitor and supervise all research and engineering work in the field of guided missiles; the other has been to assure appropriate priority handling of all guided missile problems in connection with their transition from the research, engineering and testing stage into production and procurement. The research and engineering responsibilities of the Director of Guided Missiles together with personnel involved will be transferred shortly to the Director of Defense Research and Engineering. We will proceed with deliberate caution with respect to the priority and production responsibilities in order not

to lose any of the momentum that the program has developed. Therefore, for a time at least, Mr. Holaday will remain as a Special Assistant to me with the assignment to continue to handle those special aspects of the program which are beyond the research, engineering and testing stage."

While Dr. York has been careful not to let the current hysteria about space and space programs throw his planning out of proportion, he has carefully thought out the logical relation of space to the ultimate goal of national defense.

Before Congress this year, the trend of the testimony—and the results that followed were obvious. National Aeronautics and Space Agency under the leadership of T. Keith Glenman, offered Congress a concrete and specific calendar of space programs to be conducted by that agency. The Defense Department representatives fared not as well. Because of this, the civilian agency walked away with most of the group and corresponding amount of the money.

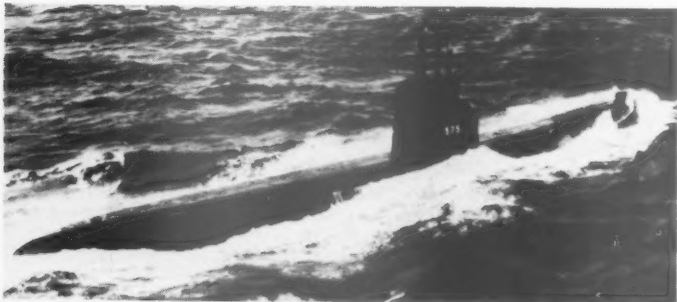
Says York, "They didn't take anything away from us. It was given to them." He adds that DOD is given the responsibility for certain space work, but only "by exception." The job in his office, according to Dr. York, is to apply the space findings of such agencies as NASA. "We can do what amounts to putting a requirement on these projects," he says.

Will handing over initial responsibility to the civilian agency drastically extend the lead time needed to build an operational weapons system? Says Dr. York, "In principle, no . . . In practice, there are a lot of people on both sides of the fence. I myself feel neutral. I mean to (a) cooperate, and (b) make the best use of the existing system. They have overall exploratory responsibility, and we exploit their results. There is no reason to combine these. We do not need a new booster for every communications experiment we run. This need for a booster unifies space work as such, but not necessarily the application. Our job here is to tie the two—booster and application in."

Does the ASW Crisis

Need a Special Projects Office?

Navy Special Projects Office and Air Force weapon system approaches have been spectacularly successful in solving tough problems in a hurry. Will another special office be needed to solve the anti-submarine warfare problem or can the answer come in the standard way without special help?



To destroy one submarine now takes all the equipment shown here and more. Navy's task: do a much better job with less.



by Bill Borklund

THE Navy has known for some time that a fair-sized gap exists between submarine offensive capability and anti-submarine warfare. There has been little steam, outside the Navy, to fill this gap—mainly because the nuclear sub which caused it belonged to us.

The certainty that Russia will soon have this weapon themselves (Best guess: by 1961) has decimated the time span on ASW. (See March AFM, page 18.) Pressures on the Navy bureau system to come up with a solution have mushroomed. Can the system handle the job in the time allowed? And even if it cannot, could a special projects approach do the job either?

This "how to" argument has been hashed and re-hashed by the Navy several times. Navy considered putting ASW into a special projects office some time ago, decided instead to let the standard organization build its ASW momentum the usual way. Among the reasons: ASW is "into, over and around all phases of Navy operations. Total responsibility for the job has to rest with the CNO." It is interesting to note, though, that lately, in spite of Admiral Arleigh Burke calling ASW a number one priority mission, support of that kind has not jelled.

In the last year, however, industry, in answer to a Navy call for help, has jumped into the ASW field in a big way, is now spending more of its own than Navy money on the development effort in many cases. But many companies are beginning to wonder if their long gambles on ASW will ever pay

ARMED FORCES MANAGEMENT

off, are becoming increasingly frustrated wandering from bureau to bureau trying to get answers, leads and hopeful indications—and drawing a blank.

This is not entirely the Navy's fault. But, it is industry which has brought up this "how to" argument again. Whether industry is right in being disgruntled is beside the point. Until this problem in communication and rapport (essentially: how to do ASW business with the Navy) is cleared up, industry will be reluctant to pour all the resources it might into ASW.

The reason ASW is such a mammoth chore begins with basic research knowledge—or rather the lack of it. We know far less about the oceans and their energies than we do about the space beyond our atmosphere. Thus, ASW is a more elemental R&D problem than those of the nuclear-powered and/or missile carrying submarine developments. This difference is the chief reason Navy has stayed away from a special horizontal-type ASW office. "Why start running when we don't know where we're going?"

Without this basic knowledge, knowing where best to apply resources for the ASW answers is like groping in the dark. There's not the time nor money for very much of this. The Office of Naval Research, Navy's basic data crew, is concerned primarily with underwater acoustics at the moment. Work on other energies (electromagnetic, infra red, electric currents) has gotten little more than a light touch comparatively.

There is no wide spectrum of scientific knowledge. (Significantly, Russia devoted her largest effort in the IGY to oceanography.) Until this spectrum starts filling in, little technical basis exists for evaluating development ideas or their likelihood of paying off. Without this basic data, Navy runs a big

risk of going down million-dollar blind alleys—and they just don't have that kind of money.

The money, too much of it, has had to go for other things. Said one top Navy research man, "At the moment, ASW research is kind of disorganized, we must admit. But we just don't have the money to get this thing going."

Navy evaluation of industry ideas, and most of them are little more than this, has consequently been vague and unrewarding, in many cases, to industry. "The industrial community," said one ASW man, "as well as the Navy, is in the unique position of not having at its fingertips the criteria involved to solve the ASW problem." ONR is the most sympathetic listener, primarily because they nurse the faint hope a random effort may stumble onto the solution; or, said one ONR captain, "Even if they don't hit the answer, maybe there'll be a significant boost in capability."

The Basic Question

Money has raised the question, too, of fundamental vs. experimental (bread board) research. The first is not very expensive. The second is. And the bread board is the proof of the pudding. Problem is, ideas are flowing in from all over the ball park which can neither be proven nor disproven.

Thus the management decision is, basically, whether a special projects office can be a hero on all critical problems or is there a time and a place? In essence, will management by exception work every time the heat is turned on? Or is it the basic Navy organization which needs changing to, say, something like the Air Force weapon system project office approach?

The answer to these questions depends, to a large extent, pretty much

on viewpoint.

Closest thing to an SP office, at the moment, is a fairly loose confederation of Rear Adm. Charles E. Weakley, ASW readiness executive in Burke's office, and Rear Adm. J. T. Hayward, assistant chief of naval operations for research and development.

Generally referred to as Burke's ASW coordinator, Weakley, (whose job will be taken over by Rear Adm. Howard A. Yeager probably in mid-May), is actually a special assistant who pulls together all of ASW's problems (R&D, personnel training, employment of forces). His job: tie requirements to a development plan, which includes everything but basic research, in an orderly fashion. With a small staff (approximately six officers) working as trouble shooters, Weakley handles user demands, works through Hayward on the problems the users can't see (basic research).

Hayward, whose promotion to vice admiral is expected any day now, is due (probably at the same time the promotion comes through) for a boost to deputy CNO for research and development. It represents an increase in authority for R&D and "this reorganization," he says, will help "considerably."

Weakley admits the bureau structure makes concentration on ASW difficult to muster but adds, "Should we reorganize to solve only one problem? This would be a mistake." Says Hayward, "Industry essentially is correct that the bureaus can't change much" but he doesn't think this is necessarily bad. Still, Chick Hayward, working through ONR, reprogrammed 47% of his R&D funds last year, seems glad he has this kind of flexibility.

In simplified terms, the standard procedure is this: Chief of Naval Operations tells the Navy Secretary

In Brief:

A marked improvement in anti-submarine warfare is something that needs doing in a hurry. But the roadblocks to improvement are monumental. They involve, basically, three things:

- 1—Lack of basic research knowledge;
- 2—Lack of money;
- 3—And from these two, lack of a central group which can say, with authority, "Yes" or "No"—in essence, a weapon system project office.

Until these three deficiencies are corrected, ASW development, like the system it is trying to build, will continue to grope for answers.



Top Navy men in ASW at the moment: Admirals Weakley, Hayward, and Yeager (who takes over from Weakley in a month).



Canadian approach to ASW, slightly different from ours for several reasons, involves only one major piece of equipment, the Argus picket aircraft.

Navy needs thus and so (requirements) in priority order to do its job. The Secretary instructs the bureaus, within budget limitations, to fill the order (in weapons, personnel, etc.). Where new equipment is called for, bureaus use basic information provided by ONR, make their own applications.

But the lack of basic knowledge coupled with the urgency of the problem means, in many cases, ASW people are trying to stretch out far beyond the current state of the art. (There is another hooker: the requirement that new programs be sold only on the grounds that they are better than current systems.) Program analysis of ASW per se is highly segmented with too many people "maintaining cognizance" and hardly no one maintaining command.

Limited bureau resources tend to overlap in search of an answer. Just as bad: there is no way to prevent the bureaus from treading on each other's toes except by voluntary agreement. Worse, from an ASW standpoint: no group responsible for vital segments of applied research, engineering development and equipment procurement is looking at ships, planes and aircraft in terms of anti-submarine warfare. The bureaus look at ASW the other way around.

Examples: Bureau of Ordnance is concerned chiefly with development and procurement of tracking equipment, fire control devices and final kill weapons; Aeronautics for devices operating from planes, blimps and helicopters; Ships for a wide range of search, detection and tracking devices as well as related communications, navigation and target identification problems.

To the bureaus, this division of effort is no cause for concern. Through a series of ASW symposia (at least one a month) and the convening of

various boards, the bureaus feel there is a good cross-referencing of information. To them, the big problem, in the past, has been not enough people outside the Navy knowing what was going on in ASW. Success, what there was of it, has been an internal thing.

Their answer to the industry complaint that there are no decision-makers is:

1—Some of these "new" ideas have already been checked out;

2—Some of their ideas don't have basic data to back them up and Navy is not in a gambling mood. (Says Hayward, "I get very suspicious if an idea is going to cost me \$100 million.")

3—Some of the ideas are quite involved and expensive for very little return.

Alter the Bureaus

Said one bureau admiral, "We have no coordination problem." Weakley backs them up on this. Stating that the Navy deputies have been very helpful, the bureaus (in general) have put money where he asked and the Office of Naval Material has contracted out on the same basis, he adds, "I haven't yet had to go to the boss (Burke) for a club to get something done."

His big problem is money. He spends about 1/3 of his time trying to get it. He lives with this on the "effort to achieve balance" basis. "Certainly, ASW is not getting enough money and ASW is a major problem. But let's not close our eyes to everything else the Navy must support—which usually doesn't get enough money either."

On the other side of the coin there are such proposals as a complete reorganization to handle this as well as any future Navy problems. Said one officer, "If they have to have bureaus, leave the support-type offices as they are but assemble Ordnance, Ships and Aero-

navics into one bureau—sub-divided by weapon systems."

Key Navy people, in some cases, indicate, at least as far as ASW is concerned, that a central group may have some merit. "It would appear logical," said one top Navy R&D administrator, "to have one office which would assemble the inputs from all these sources; compare one with the others; and pick the most promising areas for concentration. Whether what looks logical is really true or not, I don't know."

Navy's big weakness in ASW (detection, localization, classification and communication) does not now have a satisfactory solution—nor is one on the drawing boards. The mass of equipment needed by the Navy today to bludgeon one sub to death is prodigious—mainly because the anti-submarine submarine can do part of the job better than the destroyer which can do part of the job better than the airplane which can do part of the job better than the submarine, and so on around the circle.

ASW tactics are virtually identical with those of World War II, although the equipment has improved some. The submarine, on the other hand, is soon to become a prime offensive weapon against targets far inland. (All SAC bases are within 1500 miles of some ocean coastline.)

The Navy job: mold the Hunter-Killer team into a more compact, more efficient outfit, cut the present mass of equipment down to something that has a reasonable chance of getting on the national defense shopping list. Comments Hayward, "No one secret is going to solve the whole problem." Adds Weakley, "The key, but not the final answer, is to lift the 'cloak of concealment'—a submarine's only defense. Sound is, right now, our best tool, but it has shortcomings." The men at sea and in the laboratories wrestling with this problem agree, generally.

Navy men say, to solve the ASW problem, is going to require a scientific and technological effort at least as great as the effort which came up with missiles. They have asked industry help. But too much of industry is beginning to feel a little like the man who was invited to a party and, on arriving, discovers the party's not until next week.

And to the Navy men at sea, how well their needs are being filled leaves a great deal to be desired. Said Vice Admiral William G. Cooper, commander of the Atlantic Fleet Anti-Submarine Defense Force, after an ASW speech in Washington last month, "I get awfully tired of traveling around the country telling people what we can not do."

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Norair Sets PACE

In Job/Cost Evaluations

Norair Division of The Northrop Corp. has developed a unique method of measuring job cost and work effectiveness. Called PACE, this is how it works . . .

by **F. W. Lloyd** Vice President, Manufacturing
Norair Division, Northrop Corp.



Lloyd joined Northrop in 1941, when the company was two years old. Heading the Norair manufacturing complex, he directs production on the Snark guided missile, the T-38 trainer, the N-156F counterair fighter, and major airframe subcontracting. He has done much work in developing modern tooling methods and management practices.

WHEN we consider the high proportion of labor to other costs in producing modern weapons systems, it seems imperative that the defense effort get the best possible value from every man-hour.

Unfortunately, this goal is harder to reach in aircraft and missile production than in industries which can use constant-speed assembly lines or other conventional pace control methods. Airframe assembly lines move slowly and intermittently, and must include many intricate, high-precision operations. The resulting environment doesn't always encourage workers to maintain a constant effort.

The Norair Division of Northrop Corp. has developed a unique approach to solving this problem. It is called, appropriately, the PACE (Performance And Cost Evaluation) Program.

Basically, PACE is a statistical means to evaluate group effectiveness in performing assigned tasks.

The program is primarily a tool for line organization supervisors. While it involves group effort ratings and statistical reports, one of its chief benefits is psychological: Simply by being in operation it keeps supervisors' attention on the working pace of their organizations.

In developing PACE, the Norair Division Manufacturing Methods Engineering Group used conventional industrial measurements, such as Time Study and Ratio Delay Study, as a departure point. Such studies are used to measure individual performance only; cumulative group effort studies are far less costly and time-consuming, are more adaptable to airframe production needs, and place no onus on the individual.

PACE uses observation and random sampling instead of cameras and stop watches. It is not a "speed-up" program. As our management carefully explains to personnel, the PACE goal is not to tax individual endurance, but to bring the general performance level up to a consistent position within approved industrial engineering limits. This involves removing such obstacles as dual functions, which may have frustrated the worker for a long time, although unknown to management.

We have found that PACE, with modifications, works as well in offices as shop areas. After considerable study, the program has recently been adapted for use in the Engineering Department. Northrop's Radioplane and Nortronics Divisions also are adopting PACE.

In a manufacturing operation, PACE works like this:

A trained observer, thoroughly familiar with the organization under study, tours the work area several times a day on a random schedule, using different approach routes. He notes the number of persons idle and the number working. He also assigns a percentage rating to the group's effort. By comparing the number of persons in the department with the number who should be there, the number out of the work area can be determined.

The number idle, the number out-of-area, and the effort rating are converted mathematically to a basic PACE Index which is plotted on the organization's chart each week. This index is expected to climb to, and remain in, a programmed control area.

Other indices—personnel level, budget realization, schedule realization, quality control and parts shortages—which interrelate with the PACE Index, are also plotted on the chart.

Supervisory personnel in each organization receive their PACE chart each Monday. The charts show progress from beginning of the program up to the previous Thursday. Any dip in the PACE line or any inequity in the relationship of PACE with the other indices may call for corrective action. If the observer notes an obviously out-of-control situation, he will alert the supervisor immediately rather than wait for chart publication.

This is how supervisory personnel might use the chart:

A foreman notes that out-of-area time in his shop has risen sharply, pushing the PACE rating down. He reviews out-of-area work assignments and finds that he has diverted personnel to engineering liaison, parts-chasing, or other activities not part of the assigned task. This indicates a costly dual function. The foreman then contacts the organization responsible for providing parts or engineering liaison and arranges better service so his workers can return to their jobs.

PACE has been in operation throughout the Norair Division's Manufacturing Department since March 1958. The program figured prominently in establishing cost underruns in prime and subcontract work. This resulted in refunds to the customer. Because PACE interacted with other control procedures, the exact dollar savings directly attributable to PACE are not available. We do know, compared with established standards in the Manufacturing Department, that the program contributed to a 21 per cent increase in group effectiveness during its first six months. With a good deal of the slack gone, we expect more modest gains after the second six months.

ARMED FORCES MANAGEMENT

This achievement did not go unnoticed outside of Northrop. Numerous key staff officials in the armed forces and leading aircraft company executives have attended PACE briefings. The Air Force and several aircraft firms have sent teams to study the program.

Before going into the details of the PACE Program, it might be worth noting two basic requirements for its success.

First, trained, well-paid, professional-level observers are needed. They should have either a strong academic background in industrial engineering, plus working experience, or long experience in industrial supervision. The cost, in ratio to return, is small: one PACE observer can cover 750 people.

The second requirement is full management support. This support has never been lacking in the Norair Division. Supervisors were briefed well in advance. Despite a few early misgivings, they accepted PACE as a useful tool and supplied the spirit and effort to make it work.

A PACE observer begins his task with a two-week basic study of the organization he is to observe.

During the first week he learns in detail the organization's job, the supervision structure, the number of persons involved, the work area layout and any other pertinent facts. He divides the work area into observation areas according to physical layout, related tasks or personnel groupings, whichever is most practical for thorough observation.

During the second week he makes 15 daily observation tours to establish the initial PACE Index. Personnel get used to seeing him. Although they have been briefed, many stop the observer and ask questions about the program. They learn he is not pin-pointing individuals for criticism, and most misgivings vanish in a short time.

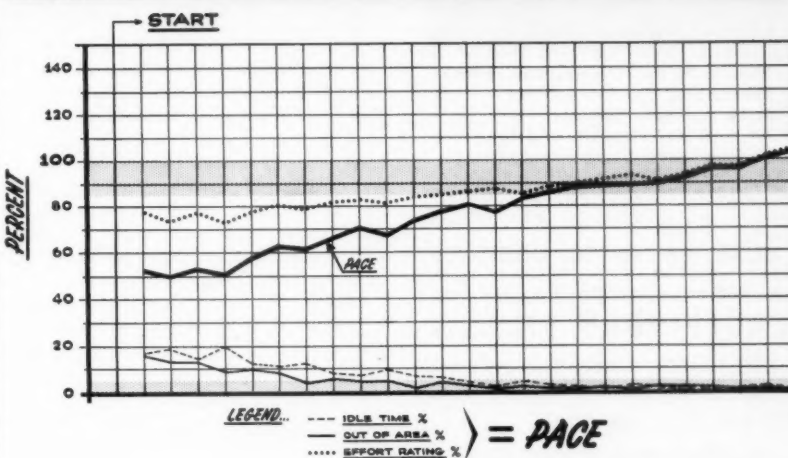
The observer moves quickly through the area. He carries a click counter in each hand, using one to count those working, the other to tabulate the number idle. As mentioned before, he assigns a percentage effort rating. He must, in effect, take a mental motion picture of the group and compare it with 100 per cent effort—the known pace an efficient worker can maintain without strain. Effort rating ability comes only from experience and intensive training. When he leaves the area, the observer enters his findings on a work sheet and goes to his next assigned area.

We have been asked repeatedly, "How can you be sure the observer assigns a true rating? After all, he's rating a whole group without even

Weekly PACE reports, as shown here, are given to supervisors of sections under study. These reports immediately show trouble spots and areas needing improvement.

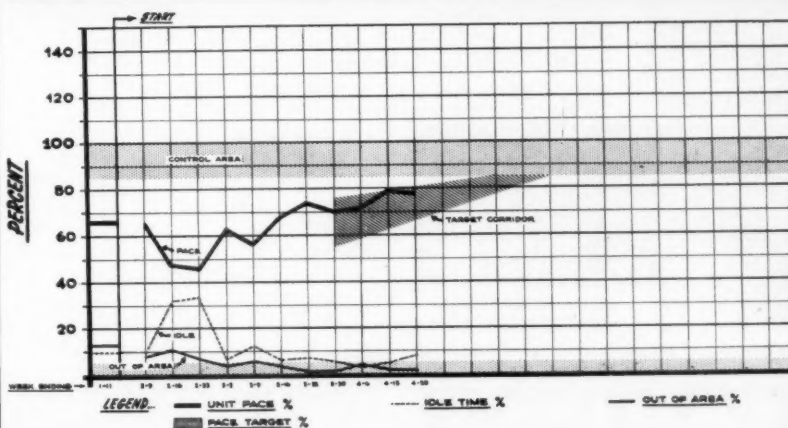


PACE FACTORS...



PACE reporting system makes liberal use of charts, showing supervisors at a glance what needs to be done to improve department performance. Top chart here shows the various factors considered in reports, Weekly report (bottom) shows how target corridor is used to set improvement standards. Charts show items including idle time, out of area time, effort ratings, then combine these for PACE rating.

WEEKLY PACE RATING REPORT...UNIT.. 54321



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slowing down!" The answer is in two parts.

1. We have use "control" observations to check our observers. Observing a given area at the same time, no two observers have ever differed more than five per cent in their effort ratings.

2. Effort rating need not have pinpoint accuracy. It is only one factor in the PACE formula. Even if the rating were off by 15 per cent, the observed organization's problem areas would still show on the PACE Index.

After the basic study, observation continues indefinitely. They are a part of the Norair Division's working routine. However, the observation tours drop to 10 per day when the basic study is over, and further decrease as the organization improves.

The starting point for the PACE line, however low, is not critical. What matters most is the trend and rate of change. The goal is to bring the PACE line into the control area ranging from 85 to 100 per cent. This area is merely a desirable norm. It is possible to exceed it.

As soon as a trend is established, a shaded "target corridor" leading into the control area is put on the chart. This keeps the upward trend constant and indicates at a glance possible out-of-control situations.

The PACE Index merely measures the diligence with which an organization applies itself to the job. Other factors bear on performance and must appear on the chart.

The Personnel Index is the organization's personnel ratio for the current week, compared to a base week. As the PACE Index improves, fewer people are needed for a given job, all other factors being equal. As the PACE line goes up, the Personnel Index should go down.

The Budget Realization Index is computed from the ratio of earned hours to actual hours spent, with the learning curve taken into account. As the PACE line rises, the Budget Realization Index will usually rise, indicating budget adjustment is possible.

The Schedule Index is the ratio of actual to scheduled production. Being ahead of schedule is just as unsatisfactory as being behind, and creates its own problems. Schedule realization is controlled by varying the number of personnel.

The Quality Index is established from a basic Quality Control formula. From the PACE Program, we learned that quality increases as PACE increases. So far, no point of diminishing return has been met.

Shortages affect PACE directly and are shown on the Shortage Index. Personnel running short of parts tend to

stretch out the work so as not to be completely idle. Since the ratio of shortages to the total number of parts is extremely small, it is multiplied by 250 to make a plottable index. Aircraft production is not geared to a constant-speed assembly line, so a small number of shortages will not affect PACE appreciably. Out-of-control occurs when the index number is over 5.

When all indices are plotted, we have a PACE chart. There is one for each area, one for the total organization, and an overall chart for each department.

Applying PACE to office activities requires minor modifications, principally in defining idle and out-of-area.

In some offices, workers are required to be out of the area often and at random times to perform assigned tasks. This factor is considered during the basic study, and the PACE formula is modified accordingly.

Some office activities require considerable mental concentration. The PACE observer allows for this in tabulating the number idle. If he sees a design engineer staring at the ceiling, and the man has work laid out in front of him, the observer can only assume that he is concentrating on a design problem.

The PACE Program is further modified for office activities by excluding the Quality Control and Parts Shortage Indices, which obviously do not apply.

No organization or supervisor is entirely at the mercy of the PACE observer. While the observers are highly-trained and carefully-selected, objectivity is further assured by "control" observations conducted by Manufacturing Methods Engineering supervisors. If their observations differ markedly from an observer's, he is given additional training. If the disparity continues, the observer would be replaced. This has never been necessary.

PACE can be applied to special problems. For example, many man-hours were lost during the last 30 minutes of a shift. The reason: supervisors were doing paperwork, and were not present to control the normal human tendency to slack off near day's end. Now supervisors do paperwork earlier and are in the work areas a half-hour before clean-up time.

The basic PACE philosophy is apparent: People would rather work than kill time. And they will work efficiently if the obstacles—both mechanical and human—are removed. PACE helps management to do this quickly and effectively. It is an efficient weapon in the battle to secure low-cost production during an era of spiralling defense spending.

ARMED FORCES MANAGEMENT

Sixth in a series on military-contractor relationships.

Industry Management: Vital New Military Commodity



by S. Kenneth Johnson
of Daniel, Mann, Johnson & Mendenhall
Architects & Engineers

THE armed forces, traditionally the largest purchasers of material in the world, are advancing heavily into a new buying activity: the purchase of management. There are few areas in the business of operating a military establishment in which professional management, either in the form of studies or executive personnel, is not actively engaged. And as the complexity of modern weapons and their use advances into increasingly specialized fields, the Armed Forces must expand their purchase of private management skills on a contractual basis if the full potential of the nation's defense capability is to be realized.

Actually, the purchase of management is far from new in the Armed Forces. During the Civil War, President Lincoln contracted with Robert A. Pinkerton for the creation and operation of an intelligence system, and World War I witnessed a wide variety of management contracts for the operation of ordnance plants, aircraft factories and government ship construction programs. World War II saw this system of contracting for management and even operation of major functions expanded into virtually all fields of defense, other than the tactical battle-field functions. These traditionally and properly are the domain of the career military man.

These past experiences contrast with the present situation in one important difference: previous management contracts supplied skilled manpower in periods of short-manpower and utilized it in fields of established, codified activities developed by the various military departments and agencies. Today, the Armed Forces seek management in specialized fields for far different reasons:

- The technology is too complex and subject to rapid change for setting forth practical standards and procedures which will remain fixed
- The job to be done is indefinite in scope, subject to sudden contraction or expansion, with the latter frequently the case
- The schedules are too tight for execution under standard operating practices
- The economies of a program can be better weighed, and practical solutions budgeted by men trained in the world of competitive business

It is in these areas that contracts are being let to highly-specialized firms with the experience, competence, incentive and imagination required to pioneer at high speed. Nowhere in the technical community are these four descriptions so aptly applied as in the missile field.

The ballistic missile has been developed almost exclusively through the weapons system concept in which not

only is the hardware purchased from private industry, but management of the complete program as well. Today, the "briefing of generals" by private contractors is an almost daily occurrence in an historic reversal of the classic military-civilian relationship. Even the analysis of future warfare and the scope of weapons for its conduct—long the proper precinct of the generals and admirals—is being offered by and executed by private industry under contract to the military forces. This is a natural evolution as scientific developments open up whole new concepts in the strategy required for national defense and the offensive prosecution of war.

It is of interest to examine the factors comprising this virtually unnoticed revolution in the management of military programs as a guide to the future. One of the great factors evident is the now accepted concept of the "team" approach to performing complex operations. Our galloping technology has long out-distanced the capacity of any single human mind to obtain, assimilate and competently utilize the amount of the knowledge required to direct an entire program. It has become necessary to provide a stronger unit. Whether this be a "committee" or a "team", it is one today in which decisions evolve of their own merit from the interaction of a group of facts supplied, analyzed, collated and resolved by a group of men. It is this alchemy of conclusiveness that is being practiced increasingly by well-managed firms in private industry and that has now broached the highest echelons of the military establishment as well.

The second factor is the increasing boldness of the task to be assayed. It is one thing to undertake to improve by ten per cent the rate-of-fire of a machine gun and quite another the placement and return of a team of men on the moon. Such projects defy even an orderly schedule of events, much less their breakdown into final specifications for equipment. The Armed Forces are letting contracts which are indefinite in scope, not frozen in objective and fluid as to target with the exception of completion dates. Surely failure and floundering of such complex programs can best be avoided by utilizing responsible management in support of the Armed Forces.

The third factor is the absolute necessity for speed in exploitation of a technological break-through and its rapid translation into hardware and concrete. The traditionally formalized methods of conducting the business of government are not designed to handle the onrush of diverse, complex developments in science and technology.

Nowhere are these factors in more elaborate conjunction than in the architect-engineering field, as it concerns itself with the design of technical facilities for testing, training and operational facilities for missiles. It is not unusual for the operational requirements and the structures involved in a new missile facility to be in a constant state of change throughout design and construction. The only factors that remain fixed are the required dates.

Construction costs are based on guesstimates. Design periods are short and reviews must be accomplished concurrently.

The additional and often deciding information now required for the selection of the architect-engineering firm is on its capabilities and record of management. It is not enough to have engineers, PhD's and draftsmen. Utilization of these talents as to application and management of the program—that is the critical factor.

Our nation is now fully apprized of the size of the challenge posed by the Space Age demands for exploitation of our complete national physical and human resources. These can only be mobilized fully by utilization of experienced, aggressive management—wherever it is found. And more and more often it is being found in private industry under contract to the Armed Forces.



How TAC Stops Limited War Before It Starts

by General O. P. Weyland
Commander
Tactical Air
Command



THE story of the Tactical Air Command's Composite Air Strike Forces is one of management of men and materials in the atomic age. It is the story of a new military philosophy dictated by international events. The story tells how the United States Air Force organized to meet the limited war challenge by drawing resources from presently available equipment and trained personnel.

At this writing, one such Strike Force has returned from the Middle East after ninety days duty during the Lebanese crisis. With as little as three hours notice, tactical jet aircraft, men and materials were on their way to Adana, Turkey. Later last summer, a similar force was alerted when additional airpower was needed in the Far East. Both of these forces went into action with smooth precision, born of long practice in mobility exercises.

The primary purpose was to deter war. There was no major warfare in the Middle East. There was limited fighting between the off-shore islands and Communist China but it did not grow into open warfare. Had not these composite air strike forces been available, the weakened balance of power might conceivably have encouraged forces to continue whatever aggressive plans they may have had in these areas.

There is no substitute in today's military program for management of men and resources. I believe the Composite Air Strike Force points the way for all branches of the Armed Services in regard to situations where limited war exists or threatens. Economy of personnel and equipment are the guides.

The first principle in managing airpower—or any military force—is to recognize the mission assigned and to prepare precisely for the duty you are expected to perform. I believe the United States Air Force has conformed to this principle.

Our Strategic Air Command has been prepared as a major deterrent to all-out war with a world-wide network of air bases and communications. It has trained aircrews to the Nth degree for their mission—preserving world peace through the ability to counter aggression.

The Air Defense Command has organized a defense of this nation through radar, missiles, aircraft and aircrews and has perfected it to the best technological excellence and human capability possible. This is their mission. Their management of men and materials speaks for itself.

Tactical Air Command, I am pleased to say, also stands ready to fulfill its mission in either limited war or all-

out war. But our tasks has been more difficult and more demanding in some ways

While SAC and ADC missions were dictated from the start by the existence of atomic weapons, TAC was the last Air Force command to be affected to the extent that it was necessary to change basic concepts.

The Tactical Air Command proceeded pretty much along its previous course following World War II. Its mission was to provide air superiority in a given area, interdiction of the battlefield and close support of surface forces. Our training and equipment were tailored to this function.

Resources management in 1945-50 dictated the following essential priorities to the United States Air Force. First we had to develop a general war deterrent force. That, of course, was primarily SAC. We put heavy emphasis on this. It had top priority on men, aircraft and procurement funds. As this command developed, we put more emphasis on ADC as a shield against enemy attack. Such a program was well considered. During that period of great vulnerability in the post war years, we developed a force which could make an attack on our nation not costly to the aggressor, but disastrous. We then developed an Air Defense Command that would make such an attack in later years, as the aggressor's capability rose, as ineffective as possible.

What is Limited War?

Our ability to retaliate and protect ourselves against surprise attack has prevented the outbreak of general war. But there have been attacks by satellite nations against small free nations.

This is the limited war.

My definition of limited war is any conflict today or in the future where the survival of this nation or the Soviet Union is not primarily at stake.

The limited war appears to be one Soviet device to circumvent U.S. general war deterrent strength. Our national policy, well known by Communist nations, dictates that we will not attack first. I believe in and defend that policy. It is correct and is in keeping with the Christian principles we live by. But it has made the limited war possible. In a recent talk, Gen. Nathan Twining, chairman of the Joint Chiefs of Staff, stated:

"... Our national policy envisages fighting an enemy, if we are forced into a war, on our terms and not on his. This means that we will not attempt to meet masses of his soldiers with masses of our own. We will meet him with superior weapons, equipment,

ARMED FORCES MANAGEMENT

techniques and tactics. Above all we must seek greater flexibility for our forces than an enemy will have in his.

"How do we get this flexibility? We get it by being able to apply the necessary degree of force at the point of tension quickly and decisively. Our overseas bases are important for this. Our naval fleets at sea with embarked marines are important. Our tactical combat jets and transport aircraft are important. Our Army divisions and other units both overseas and in this country are very important. And I would not overlook our primary atomic retaliatory force which certainly can contribute, if necessary, in situations less than all-out war. We must be able to meet a local war situation with forces varying from a single warship or marine battalion to several Army divisions and Air Force wings."

The Joint Effort

As is the case in general war, no one service has a monopoly on fighting a limited war. Each must contribute what it can to the best of its ability. This is management in the Atomic age. Through proper management of personnel and resources we can achieve adequate deterrent forces against the limited war as well as the general war.

The satellite nations or nations where there has been commercial infiltration offer the "safest" means for Red expansion. Should such nations become involved in a small or limited war, it is doubtful that our great retaliatory force would become involved. Air power management would dictate that Strategic Air Command remain on alert for general war, along with Air Defense Command. Consequently, Tactical Air Command, the Marines, the Army, and the Navy must resolve the limited wars.

Several years ago we in Tactical Air Command made an assumption that Army, Navy and Air Force units, while spread throughout the free world, would not necessarily be immediately present in sufficient strength to deter or halt limited aggression in those areas where it might occur. We further assumed that whenever such forces were available in sufficient strength would be precisely where limited warfare would not occur.

The need for immediate availability of modern forces, therefore, is dictated by the hypothesis that limited war poses the greatest menace in areas where U.S. forces were not available in strength at the time an attack was launched.

Our planning staff arrived at a valid conclusion—if sufficient forces could

be offered and delivered to the threatened or attacked nation in a matter of hours, there was a strong possibility of deterring a limited war. I say possible since an aggressor, even in a limited war, wants some assurance of success. We hoped to deny him even a shred of success.

Speed was to be the criteria for movement of forces into the limited war. Speed combined with firepower. Firepower combined with economy of force.

Economy as we saw it could be offered in applying the right degree of pressure at the right spot at a given time. Firepower would offset numerical disadvantages we might be faced with. Management would prevent the arrival of too little too late or worse, too much too late.

Our solution in Tactical Air Command was the Composite Air Strike Force. It was simple in concept; so many fighters, so many bombers, so many troop carriers, so many reconnaissance aircraft, until we had the right amount of tactical air for the specific job.

The economy of the force was attractive. With its wide range of firepower, the tactical fighter is the most efficient weapon system in the Defense Department inventory. If the target calls for *any weapon* from a 20 mm cannon shell to a nuclear weapon, the tactical fighter can deliver that weapon. Only the tactical fighter has such flexibility in firepower. Tactical bombers also fit into this category.

If it would be possible to move such modern jets into a threatened nation in a few hours, we reasoned, would this not act as a deterrent to such limited wars? A complete study of several possible situations indicated it would.

The Early Problems

Naturally our problem in those early years centered around mobility. We now have the KB-50J, a jet augmented tanker capable of refueling three tactical fighters simultaneously. Supplies we realized, would not be immediately available so we established a "fly-away kit" requirement for our combat ready units. Control of such forces would be necessary, so we established the Nineteenth Air Force with less than 70 personnel to exercise and control this force. Here is another example of economy in management. From the Nineteenth Air Force comes the direction for planning, operation and training of these limited war forces. This releases the Ninth and Twelfth Air Force from this responsibility and centralizes it in one agency. Overall this has re-

sulted in a better and more efficient organization in Tactical Air Command. The Nineteenth Air Force plans for all contingencies associated with the use of a strike force throughout the world. It also develops plans for the use and implementation of such forces and keeps them up to date.

The results of this staff planning and training over the past four years became evident recently during events in the Middle and Far East. In each case a Composite Air Strike Force was ordered into sensitive areas of the globe. In each case the strike forces moved smoothly into place.

In twenty hours after notification to send a Composite Air Strike Force to the Middle East, we could have initiated a combat strike. The movement of a similar strike force in the Far East followed the same familiar lines of the Mobile Zebra exercise last winter when we placed tactical bombers in the Philippines in 17 hours. It was during that same exercise that our tactical fighters completed a 700 mile simulated nuclear mission within four hours after arriving in the Far East from Cannon AFB, New Mexico.

'Only the Trainer'

The strike force sent into the Middle East filled a void in American airpower, supplementing Naval airpower in the Mediterranean. The strike force into the Far East provided the Pacific Air Forces with additional highly trained aircrews and first line jets, giving us a substantial increase in Pacific airpower.

This then is the Composite Air Strike Force: a relatively small organization, complete with all necessary equipment and weapons ranging from the conventional type to nuclear. Personnel of the force are drawn from various TAC units trained for general warfare, eliminating the need for special small war forces. Supplies needed for the force are prepackaged for airlift, eliminating time consuming surface shipment which would otherwise prevent the forces from going into action immediately upon arrival. Mobility time is based on the arrival of the first supersonic jet to the last turbo-prop transport, putting a complete force at any point on the globe in from one to four days. All extras are eliminated. Only those men who will contribute directly to combat operations are included in the force.

The CASF is like a fighter entering the ring who brings with him only his trainer and second, who in turn bring only that equipment needed to keep their man fighting to the final bell.

This is management of fighting forces in the atomic age, Tactical Air Command's answer to the limited war.

Pro and Con on the Bogeyman

The two letters reprinted here are representative of many letters received, as a result of "Civil Service: The Management Bogeyman," a

reader's comment in the February ARMED FORCES MANAGEMENT. There is much to be said on either side . . .

Rebuttal: Stonewall Mistaken

WE have noted the letter, "A Reader Comments on Civil Service: The Management Bogeyman," by a Mr. J. K. Stonewall, published in the February issue of ARMED FORCES MANAGEMENT, and also your editorial prelude which reads as follows:

"As an indictment of a group of people, this answer to our December editorial is not, we believe, quite accurate. But, as an indictment of a system, it appears to have better guidance than the Atlas missile."

Mr. Stonewall's position, with which ARMED FORCES MANAGEMENT finds itself in such substantial agreement, is simply another version of the old, tired and long discredited contention that "efficiency" somehow is thwarted by "civil service red tape." In putting it forward once again Mr. Stonewall incidentally smears American citizens who are making a career of civil service, often at substantial personal sacrifice. While doing so, moreover, he hastens to anticipate any protests which may arise as a result of the smear, deriding them as "tear-jerking untruth."

What are the facts about civil service vis-a-vis "management efficiency?" The provable facts are that civil service is by long odds the most effective method yet devised to insure efficiency in so large and complex an organization as the Federal Government, and to place the recruitment and retention of personnel on the basis of merit and performance rather than patronage, whether political, personal, old school tie, or any other form of favoritism.

Against Mr. Stonewall's view of the civil service, and what he regards as its unique and stifling "red tape," let us place the experience of qualified business leaders who have served in both industry and Government . . .

Clarence Randall, long-time Chairman of the Board of the Inland Steel Corporation, who is still an advisor to President Eisenhower, as written in *Life* magazine.

"The government red tape which we despised may be merely the living embodiment of the checks and balances which the founding fathers wrote into the Constitution. They were determined that under our system no single person should ever have too much authority. They placed limitations on every power they created."

Mr. Randall, after paying high tribute to the career civil service employees, said that ". . . By the familiar accounting standards of dollar volume the money transactions so far transcend the gross of our largest corporations that no (business) executive comes to Washington with more than an apprentice background. No man lives whose mind apprehends all that government encompasses; the oldest and wisest are amazed at finding something new about it each

day. For example, in foreign economic policy, which happens to be my special interest, there are 24 departments and agencies that maintain American personnel abroad.

"Many businessmen would declare that such duplication and overlapping are ridiculous. I would have probably thought so myself, but my thinking has undergone a change since I have seen these problems at first hand. I recognized in myself a new tolerance, a new hesitancy to condemn what I have not carefully examined. I now suspect that this multifariousness in representation abroad may be inescapable. In any case, I am sure that proposals for revolutionary change must be approached with great care . . ."

. . . Scores and indeed hundreds of similar statements could be presented to show just how far off-base Mr. Stonewall's article really is.

But he indicts himself most seriously. For example, he states, without documentation of any kind or description, that he "watched a man cause the Government to pour almost a quarter of a million dollars down the drain because it meant a two-grade increase for himself."

This is a damning charge and because it is made without any identification it makes all employees suspect. At the same time, the questions arise: What did Mr. Stonewall do to call this misfeasance to the attention of responsible authority? Was Mr. Stonewall himself in a supervisory position? Did he himself fail to act? Is he prepared to back up his charge with facts, names, dates, places, as is properly required under the American system of justice?

None, least of all career employees, hold to the view that the operations of the Federal Government can not be made more efficient. There is constant, and rewarding progress being made in that direction. More can, should, and undoubtedly will be made. As a single instance of many that might be cited, the relatively new Incentive Awards Program already is saving the Government millions of dollars through improved methods.

We are not surprised at Mr. Stonewall's radical prescription—namely, burning down the house to make it easier to get from one room to another—because it is wholly in the historical pattern of these roundhouse accusations.

What is shocking, and deeply disappointing, is to read the editorial comment of ARMED FORCES MANAGEMENT which finds that Mr. Stonewall's letter ". . . as an indictment of a system—appears to have better guidance than the Atlas missile."

In the interest of fair play, we believe that this presentation should be given no less prominence than Mr. Stonewall's attack on civil service and the men and women who serve the Nation in it.

President
National Federation of Federal Employees

VAUX OWEN

ARMED FORCES MANAGEMENT

Affirmation: The Next Step

THE article published in the February ARMED FORCES MANAGEMENT entitled "Civil Service: The Management Bogeyman" contains a considerable amount of truth, but it is also "not quite accurate" as your editorial comment stated. I find particularly objectionable the author's emotional indictment of the individual civil service worker. Based on ten years of analyzing the on-the-job activities of such workers, it is my opinion that most of them perform their duties in about the manner in which they are instructed by their immediate boss. The fact that civil service employees will react to work situations to their own advantage should not be surprising. The competitive business world is founded on exactly this premise, and since people are human, whoever they work for, it would be amazing to find it otherwise in civil service. It must therefore remain the system which is indicted rather than the individuals which staff the structure.

There should be no serious doubt that the civil service system as it operates today is about as outdated as a horse and carriage on a modern freeway. However, while making this valid point, Mr. Stonewall did not attempt to present any workable answers or improvements.

The basic answer to Mr. Stonewall's article lies in one thought, as follows: We must provide individual (or group) incentive pay to the government worker. We must modify the existing civil service pay scales, both blue collar and clerical white collar jobs, so that pay is earned by *piece rate production*.

The advantages of this proposal are as follows:

1. The worker can achieve substantial earnings by doing his job well. The need for about 70% of Civil Service employees to hold two jobs to earn a living wage would be largely eliminated.

2. Individual incentive would be substituted for organization incentive as found in business, and the government (at least concerning the broad base of employees) would become as efficient as business is generally.

3. With wages based on an engineered time standard, the individual must produce a specific amount to earn his basic wage, and if he produces more, he can earn more wages proportionate to the increased production, up to the limit of his capacity.

4. Since the exact production of each worker is measured and processed for wage payment, the indolent, non-productive individual is immediately spotted, and presumably trained to produce, transferred to more suitable work, or separated.

5. By a reasonable ratio of workers to supervisors, the supervisory staff is kept within bounds. It is generally considered unrewarding—if not impossible—to attempt to apply engineered time standards or any type of piece work pay to supervisory personnel. However, under an incentive program the supervisor finds the pressure on himself considerably increased.

6. Workers will welcome methods improvements in their jobs. Improvements in methods originating under such a system have frequently increased productivity as much as 400% on a single job.

The idea of applying Engineered Time Standards resulting from time studies or Methods-Time Measurement certainly is not new. Directives were issued by Department of Defense in 1956 requiring their development in all branches of the service. Millions have already been spent on this program, and a great many more millions have been saved by application of the standards, but the present coverage is far from complete.

The idea of coupling incentive pay scales to engineered time standards is not new to the government either, but it has not been applied generally. *The two must be coupled to insure reasonable efficiency throughout the Federal Government.* The one successful case I know of occurred in 1948 at the U.S. Marine Corps Clothing Depot, Philadelphia. Here a large number of garment industry workers were recruited during World War II to manufacture Marine Corps uniforms. Since the clothing industry is traditionally a piece work industry accustomed to time study men, the transition to a piece work incentive pay system was accomplished with little opposition. After the engineered time standards were completed, the Civil Service Commission was contacted and application was made and approved to establish a separate incentive pay system based on the pieces of work produced by each employee. During the first year of operation of the engineered time standards and incentive pay program, a 20% reduction in operating personnel resulted in a savings of \$800,000.

Engineered Time Standards and incentive pay systems can be applied to every type of repetitive, routine work. This includes the great majority of federal employees. It can be applied effectively to all types of shop work, as has long been traditional in industry, to warehouse operations, to shipping, receiving, packing, car or ship loading, to paper work including reading, writing, typing, filing, office machine operation, to all janitorial work, to all maintenance work including carpentry, plumbing, painting, electrical, electronic, sheet metal, pipefitting, in fact all jobs included in "the trades" can be effectively covered. "Universal Maintenance Standards" are in use which can be applied to any activity with very little difficulty.

In supply type work, standards coverage is more rewarding than in the typical shop situation. Supply activities can be covered economically 100% in most instances. This is not usually true in shops because of the infrequent occurrence of some types of the work. However, statistical standards can be cheaply and effectively applied to such areas. Certainly the development of such a system leads to more of the complexity about which Mr. Stonewall complains. But the government is big and complex, and that cannot be helped. The important thing is to make it efficient, and incentive pay is the only practical way to do it. However, it should be effected on a service-wide basis.

It is perfectly true that the efficient activity may get badly hurt in a service-wide percentage personnel cut. At present, this sort of thing places a premium on padding. However, if pay scales were geared to production in all operational level government jobs by the Civil Service Commission, there would be no great difference in the relative efficiency of different activities or services. It would also make it much easier to base a reduction by decree on operational facts which would be much more equitable to each activity, if such methods of reduction were necessary.

Probably such a drastic change would have to start with Congress, as have many economy drives in the past. But, the important thing is that incentive pay provides a really potent leverage to obtain efficiency. The passing of such substantive legislation is much more than the usual lip service to economy, efficiency, etc., and it is certain that considerable opposition would arise, but few in public office will admit to favoring inefficiency. The government already has an elaborate auditing system to check on expenditures. The application of this talent would, I am sure, eliminate any doubts as to fraud in connection with such a system. With the application of incentive pay systems to each trade, craft, or clerical skill, the government worker will be able to look his business world brother in the eye and truthfully state that he is just as industrious, hard-working, and efficient.

DONALD W. DeVOS

Managing R&D:

Provide, Don't Prevent

Somebody once said that the research manager's job is to find ways around the rules, rather than to enforce them. Two top research administrators here set down five ways for the manager to make the researcher's job easier . . .

"COMMANDERS should be counseled chiefly by persons of known talent, by those who have made the art of war their particular study, and whose knowledge is derived from experience, by those who are present at the scene of action, who see the enemy, who see the advantages that occasions offer, and who, like people embarked in the same ship, are sharers of the danger. If, therefore, anyone thinks himself qualified to give advice respecting the war which I am to conduct—let him not refuse the assistance to the State, but let him *come with me into Macedonia*."

Thus spoke Paulus of ancient Rome concerning the conduct of his mission. Lately having served in the Macedonia of research and development, counsel from knowledge derived from experience can be shaped to aid those who must further carry the campaign.

Our experience in managing research and development installations demonstrates a first important lesson. We manage the organization in which R&D is performed. We do not and cannot manage research or development directly. The manager of the laboratory succeeds when he is able to create the proper atmosphere for encouragement of creative and adaptive people. He makes his contribution by finding the obstacles ahead of his people and either reducing them or boosting his people over them.

The administrative obstacles to getting the most for the R&D dollar are

often more difficult to overcome than the technical. Unlike problems in physics and chemistry, these problems fight back. Moreover, they are frequently placed in the path by conscientious, albeit misguided, efforts to improve managerial control. The physical obstinacy of the universe created more than enough dampers on scientific productivity. Do we have to add to them through faulty management policies and practices? With fixed manpower ceilings and budgets, each man-hour or dollar used for solving such managerial problems amounts to an unnecessary decrease in the amount available for solving the technical problems.

The Five Steps

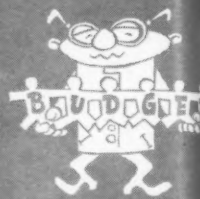
From the point of view of the manager in a government research and development installation, marked improvement in the effectiveness of the installations could be obtained by five changes in managerial controls presently applied to operating laboratories. To make the situation clear, the changes are based on experience of an organization that must operate under a fixed manpower ceiling and limited funds.

First, give continued financial support to a "hard core" of major competences. The most valuable asset of the R&D laboratory is its accumulated experience in doing things other people haven't learned to do yet. In the modern laboratory there are

Five Ways to Manage for Research



1. Support The Hard Core



2. Don't Decimal Budgets



3. Make Reports

groups or teams which build up a dynamic "art" and keep it alive by the sharing of knowledge, insight and intuition. Experienced managers of laboratories know that these groups normally take several years to reach peak effectiveness. Further, the art can't be kept vital, expanding and valuable on "paper-pushing." Good teams must have a chance to continue to do challenging, dynamic work over a period of time.

"Off-on," "Stop-go" fluctuation in the support of research and development is certain to destroy the team. They are, like Humpty-Dumpty, un-mendable. The threat of erratic support is supposed to be decreased by the use of "no-year" appropriations. By the time expenditure limitations, apportionments, allotments, program management and "kitty-itis" take their toll the normal period of certainty of support has become one quarter—three months. Under these conditions only penal brinkmanship, unremitting vigilance and skillful managerial footwork can prevent disruption of vital work.

The support of R&D must be steady and at a level sufficiently high to overcome "problem drag" and keep at least a constant velocity if not acceleration. For example, a research task requiring attention of a group of five scientists for three years cannot be solved by three scientists in five years any more than ten men can cross a river in one hour because one man can do it in ten hours. Nor can one man do it in twenty hours with half an oar. This simple analogy exposes the fallacy of cut-backs in the support level. There is an optimum level of support below which we can-

by Lt. Col. John A. Ulrich
Commanding Officer
Diamond Ordnance Fuze Labs

and

Eldon E. Sweezy
Special Assistant
Office of the Commanding Officer



not get results and above which we can be wasteful.

Second, recognize that more addition and division of dollars is not better control and improved management. The only valid control decision in military research and development is, "Does the United States need this information or device enough to pay the cost?" The defense value of the information and the probable total cost of the project are the two factors upon which such a decision can be made. Time limits are important in both value and cost factors. The present practice forces the research and development organization to spend separately the money which comes to it for one purpose from different appropriations or sponsors.

This may be precise and "in accordance with sound accounting principles," but it causes the taxpayer to pay more for less. The project manager must divert his attention to the honest allocation of his costs to the separate pockets or he must become a liar of convenience to meet the accounting rules. Why?—What difference does it make whether you pay for the baby's shoes with Federal Reserve notes or U. S. Treasury silver certificates—the cost is the same. A fraction of the brain-power now wasted in the "separate pocket" game could give simple, honest accounting for the costs of research and development.

Such a simple method exists, and has been used with excellent results in a few government laboratories. A revolving fund of working capital reduces the separate pocket problem. It is easily and simply combined with an accrual cost accounting system to

give the laboratory manager effective control over costs. We can thereby obtain substantially lower administrative expense than with the usual allotment accounting system. Such a system has been used by business firms and industrial laboratories for many years with notable efficiency. It is not inconsistent with governmental requirements when a properly defined performance budget is used. The beautiful simplicity of the performance budgeting—cost accounting—revolving working capital fund system has been decimated, decimal point by decimal point, by the substitution of detailed restraints upon the use of money for delegation of authority and courageous program review.

We cannot ignore the fact that a financial system that best serves organizations which produce ideas may not be identical with that best suited to the purchase, storage and issue of bandages, shoes, and ammunition. Uniformity can become a fetish. It really has no value in itself. Forced uniformity is implicit in massive program management and reporting systems. They go too far when a manager is given artificial composite criteria in the mistaken belief that he should not be required to comprehend the more numerous real criteria for his complex group of functions.

Third, reports of results of managerial actions should replace present statistical reports of work activity. For many years "management by exception" has been recognized as the best base for managerial control. Because of our failure to manage on this basis, today's flood of detailed data from subordinate echelons is more than headquarters can chew, much less digest.

The volume of data defeats itself. Each person, in spite of reports control and work simplification, has succeeded in getting everything reported to him he will need—"in case." Special reports must be used to obtain pertinent data lost in the avalanche of irrelevant minutiae. The desire to answer questions accurately and promptly is a legitimate one. Most of the avalanche arises from our failure to use suitable standards for evaluation of the effectiveness of installations.

Laboratories are more difficult to evaluate than some other activities but within each there are criteria of effectiveness which its manager has found valuable. These differ markedly from those used for other functions. The same criterion may not be comparable between laboratories but certainly the trend within the same organization is a meaningful indicator.

For example, the per cent of total manpower devoted to direct technical work, the number of patents and significant papers produced, the proportion of technical manpower devoted to new problems as distinguished from improvements on solutions to old problems, the ratio of overhead costs to direct labor costs, the rate of voluntary separations of professional staff, the extent of participation in advanced technical training, the average age of the professional staff, and the balance between funds available and manpower are among the simple but powerful instruments for evaluating the health of the laboratory. Only one of these, overhead cost ratio, is normally required to be reported.

If his managerial performance is evaluated on the basis of the data now reported, no laboratory executive has reason to feel urgency or pride in the picture the reports show. The performance of his real mission—the creation of new, useful and timely technical information—is not reflected.

Fourth, inspections, surveys and audits should be based upon the accomplishment of mission objectives rather than mere compliance with "the book." Any large and dispersed organization which operates under a complex set of laws must have some standard procedures and some limits upon discretionary use of authority. It is also axiomatic that "if you make a rule you must hunt the man who breaks it." There can be no argument about the need to survey and inspect for compliance. But—is there any need for the constant procession of survey teams through the gates of every installation? Must inspections be in duplicate or triplicate?

At one laboratory, only two inspections of the 40 plus in five years were concerned with the laboratory's capa-

bilities for meeting its mission. Those two surveys were made by the next higher line commander. All the others were made by staff specialists, emphasizing CONformance not PERformance. They had the avowed purpose of helping the commander not get in trouble. The staff specialists were not qualified to evaluate mission performance. Qualification to inspect must be based on qualification to perform. Fear, alibi files and suppression of initiative are the ultimate result. If a man is to have room to be right he must have room to be wrong. When the penalty for mistakes becomes too great not even daring men will risk failure.

Encourage Initiative

In the long run, increased effectiveness will come from contributions to deeper, broader competence and encouraged initiative in mission performance rather than from administrative restrictions and citations for violations. The first step in improvement would be to distinguish between deviations in discretionary and mandatory matters. The significance of both types of deviation should be judged in terms of the effect upon mission accomplishment—as long as dishonesty or abuse of power is not involved. Some improvement has been noted in recent years in the personnel management surveys by the attempt to increase educational rather than disciplinary results. Until education replaces regulation as the objective, it might be profitable to establish a “standard cost per nit picked” as a measure of the relative value of inspection.

Fifth, use individual competence as a direct basis for both salary scales and job assignments. Laboratories are in the business of exploiting the human mind of ideas. The worth of an individual staff member to the organization depends upon his ability to contribute to the solution of technical or managerial problems. This ability is in turn dependent upon competence and opportunity. Since opportunity to contribute is itself controlled by competence, it is obvious that the only measure of worth to the organization is the sum of knowledge, attributes and skills which an individual is capable of applying to the laboratory's problems. A fair salary must be based upon relative worth—that is, the useable competence of the individual.

Laboratories exist to solve problems others haven't already solved. To do this there needs to be a high order of flexibility in the assignment of staff. The best qualified men available should be brought into the project group—regardless of their salary level.

Job assignment in the laboratory must be based upon competence and availability. Of these competence is again the controlling factor. Hence, job assignment must be directly based upon competence rather than the resultant organizational status or salary rate.

Individual qualifications are, therefore, the logical basis for salary determinations and job assignment in the laboratory. The basic premise of the majority of job classification schemes is that pay is determined by the position requirements rather than the attributes of the person filling the position. We labor mightily to base the assignment on competence today. The amount of fiction introduced in duty descriptions is a measure of the complexity introduced by our present system. Our energies are dissipated in the conversion of competence to job assignment to pay. Current efforts of the Executive Office of the President and the Civil Service Commission to change the standards for scientific positions to give more weight to qualifications and less to the level of the position in a management pyramid can only lead to improvement.

Some industrial laboratories have been successful in establishing a simple framework of major pay classes based upon clearly defined qualifications (command of the scientific field, technical or problem versatility, originality, and for some individuals, managerial ability). Within these salary ranges, managers are permitted to fix rates in order to motivate and reward the more productive and recognize the less spectacular contributions of the “solid and dependable worker.” Under such a scheme, each new task is staffed from the pay groups that equal or exceed the qualification level considered minimum for the task. Present Federal position classification standards permit establishment of purely technical, non-managerial jobs at all grade levels. It would seem that administrative timidity and tradition are keeping us from freeing the scientist and engineer from a fixed position as a basis for job assignment and pay.

Make it Honest

Too often timidity, tradition, each man's desire for some secure and stable home in the organization and some men's craving for power over others combine to block the flexible use of the “brain-hours” of the staff. Criteria for evaluation of level of competence and rigorous assessment by men of unimpeachable integrity and technical competence are the foundation for improvement. Assistance and encouragement from outside the laboratory would enable the manager to turn his atten-

tion to the internal aspects of the problem.

All of these proposals are aimed at problems entirely, or in large measure, rooted outside the laboratory. The solution of them is beyond the discretion of the manager of a laboratory. He can allay the symptoms but the cure is beyond his power. He can contribute when his experience is given its proper value. It will be necessary to vary the systems of management to fit the activity.

Recognition of the necessity for fitting a managerial system to the unique nature of the functions managed is explicit in the new Army Management Doctrine (AR 1-24). Staff specialists will find their jobs more complex. This is not too high a price to pay for improved effectiveness at the operating level and more informed control at managerial levels.

Why It's Worth It

Whether in uniform or as a civilian, no more rewarding experience can be found than that in the job of giving inspiring, forward-looking leadership to the dedicated scientists, engineers and administrators in our governmental laboratories. The challenge of sustaining the unpredictable process of discovery and application is magnetic. The problems encountered, some of which are discussed here, can decrease but cannot deny satisfactions derived from achievement. Their solution can be found and the potential energy thus made available will give added impetus to the creative effort.

We do not need to stumble toward solutions aided only by the light of fox-fire from the swamp of managerial indifference. Patrick Henry said “I have but one lamp by which my feet are guided and that is the lamp of experience.” In the light of our experience there now lie before us five clear steps to improvement in effectiveness of research and development installations:

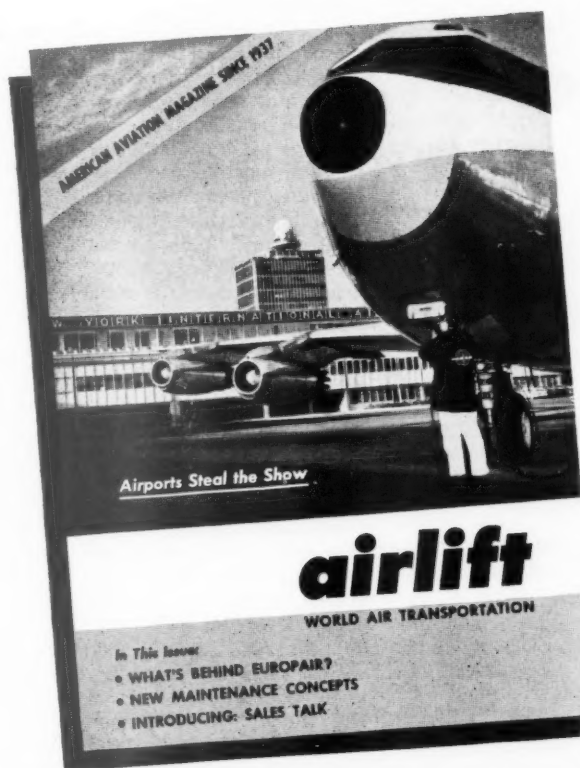
1. Provide assured support of “hard core” competences;
2. Preserve the simple integrity of performing budgeting—accrual accounting—working capital fund financial management systems for laboratories;
3. Use reports of managerial accomplishments;
4. Base inspections, surveys, etc., upon mission performance rather than more regulatory conformance;
5. Use competence as a direct basis for job assignment and salary determination.

Beyond lies Macedonia.

airlift

MAGAZINE OF WORLD AIR TRANSPORTATION

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Undersea Support and the Navy's Future

Atomic submarines and the Polaris weapon system have forced a thorough reassessment of Navy support work. This is why . . .



IF ONE nuclear powered submarine with an Albacore-type hull can cover twice the area that former conventionally powered submarines could, then it would seem to follow that only half as many nuclear submarines are needed. If only half the number of submarines are needed, then the logistics problems are cut in half, and the nuclear submarine is one of the greatest problem solvers that has come along for a long time, from a supply standpoint.

The foregoing is about as accurate as saying it is twice as easy to fight a war with only half an army—or saying that the internal combustion engine was a great aid to logisticians of another era, because they no longer had to feed horses. They are all pleasant thoughts, but they won't work.

The nuclear submarine, because of its double capabilities, must have twice the reliability built into it. It must be able to operate without serious breakdowns for many months. Because space is at an absolute premium in a submarine—and this is even more critical in the nuclear powered craft—the submarine is not able to carry the wide range of repair/replacement parts that can be carried in the surface ships.

On top of this, the nuclear power plant is as new today as was the internal combustion engine 50 years ago. It is more than a little difficult to predict exactly what will be needed—and when it will be needed—to keep the nuclear subs at their top operating efficiency. Also, many future nuclear underwater craft will be mated with ultra-complex missile launching systems. These are the problems. Charged with solving them are Navy's Bureau of Supplies and Accounts, the Special Projects Office, and VAdm. Hyman Rickover's office of Nuclear Propulsion.

One naval officer working with the Submarine and Nuclear Repair Parts Supply Demand Control Point, has this to say: "Basic support for the nuclear ship is essentially the same as for conventionally powered ships." The atomic powered submarine is still essentially a submarine, and has many of the same supply needs—the crew must still be fed, the ship must still be steered, and the electronic navigation gear must still function.

The major difference lies in the powerplant, and the unique requirements that its endurance generates. The goal in the Navy is to build into the atomic subs a full year or more of continuous operations. It is an interesting comment on the study and preparation that went into the nuclear power plant itself that the majority of parts failures to date have been in conventional equipment on the submarines.

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Unlike conventional craft, the nuclear ship does not need extensive fuel supplies to keep it going. While this creates the advantage of space—fuel storage space is no longer needed—it immediately creates the problem of need for other supplies, such as food, ammunition and repair parts for other equipment.

To fill these requirements, Navy has used its regular supply channels, but these channels are unable to handle many of the unique problems associated with nuclear craft. Among these is the inability to make extensive repairs on the A-sub at sea, as is done with conventional ships. The major reason is the need for above normal standards in many of the nuclear parts used.

Many nuclear parts are interchangeable with conventional parts, but many are custom made with special alloys and steels. Also, there are new fabrication processes and standards, and extremely close tolerances, calling for extraordinary quality control and inspection procedures. Sterility requirements call for lint-free gloves to handle the parts in dust-free compartments. This last item creates many difficulties in trying to carry out repairs at sea.

Navy has outfitted the USS *Fulton* as a nuclear submarine tender—the first of its kind in the world. Starting its new job last year, the *Fulton* is geared to handle both conventional and nuclear submarines. As a side light, nuclear submarines have done away with the previous concepts of at-sea supplying. Because of their tremendous cost, and because of their relative defenselessness to attack when surfaced and tied to a tender, it would be much too risky to have more than one tied to a tender at one time. Working on a single ship basis, the process would be too uneconomical and time-consuming.

The greatest problem with the newness of the submarines from a supply standpoint is that the Navy has no figures on which to base their provisioning lists. The best they can do, says one officer is to work "by guess, by God and with the manufacturer's recommendations." The number of spare parts carried is limited, and "manufacturer's here, as in other areas, are interested in selling as many repair parts as possible."

While the extensive shore tests that the Navy ran on the reactor did much to clear the way for efficient provisioning, it was not until the ships were actually sailing that Navy was able to verify their figures. And when the ships went to sea, the problems in supply had to be met. According to one officer, "We know now pretty precisely what we will need. But one of

the hardest things to do when we go from drawing board to operations is to predict this."

One of the major difficulties in predicting these needs is the complexity of the system. The first submarine had seven parts—including the one-man crew. To a great extent because of the nuclear submarine program, spares requirements for submarine parts have approximately tripled in the last five years alone. While many of these parts are not nuclear components, the problem is still a great one—but one which will be handled with the conventional Navy Supply System.

One great aid in solving the space problem has been Navy's adoption of the bin parts storage system. Formerly, when space was not as critical, each major piece of equipment on a ship was supplied with its own spare parts box. By taking the ship as a whole, and computing spares needs on that basis, Navy found they were able to make drastic reductions in the number of items that had to be carried. In the case of the nuclear ship, resulting space savings are in the neighborhood of 70%.

Meeting The Problems

To overcome technical difficulties, Navy has begun a thorough training program for its personnel, who will be working with the nuclear ships. The course is highly technical, and requires technical background on the part of the students. During the two-week course, the students learn how the power is generated, how it is transmitted and the problems connected with running a nuclear fleet.

Given these problems, it is encouraging to quote BuSanda's program officers again: "We haven't had any problems we haven't been able to meet. The toughest part of the nuclear submarine supply problem is over."

Besides meeting the foregoing problems, the nuclear submarine operation has actually been able to make headway against them. In spite of the increasing numbers of nuclear-powered submarines that are coming into Navy's inventory—and the resulting problems—Navy has been able to make several improvements in their nuclear supply mechanism. Although it is "hard to name any one thing" as the cause, the number of people working on the program has actually dropped since its beginning.

One means to this end was to combine the technical and cataloging sides of the office. The reason, simply stated, was duplication of effort by the separate offices. By combining them, the duplication was eliminated. Another means of doing the job better was increased use of Automatic and

Electronic Data Processing Systems. Late last year, the BuSanda office installed its own Burroughs Datatron, to speed the problem solving times.

As BuSanda officials point out, what they are doing is simply the "continuing process of finding improvements you can make in management." The testimony on their success in this area is plainly shown in the smoothness with which the nuclear submarine was integrated into the fleet.

In an earlier stage of development, but operating along the same lines is the Polaris submarine/missile system. Under the direction of RAdm. W. F. Raborn's Special Projects Office, the Polaris program is creating supply problems as difficult or more so than the atomic submarine. Again, the reasons stem from the complexity of the system and the high degree of reliability needed.

According to one BuSanda representative attached to the Special Projects office, "It's a little early, but we see no procedural problems. There's nothing really out of the ordinary, just a little more of it. We're building so fast that we don't have all of the design data at our fingertips. The only major problem is the time problem—that of capsulization."

To get the job done, Special Projects is relying heavily on the existing Navy Supply System, which means "that much more liaison. We are dealing across the entire Navy Supply System. Ours is strictly a team effort, and by using the existing Navy system, we're calling in the experts."

This, one BuSanda officer points out, is a major difference between Navy's way of doing business and the Weapons System operation in the Air Force. By retaining their commodity managers, Navy is able to draw on past supply experience to get the Polaris to the fleet in the shortest possible time. "By using the normal supply and fiscal channels, we are establishing the way for an easy return to normal supply organization when the development phase of the project is over."

Generally, supply support for the nuclear submarine was built to fit the existing Navy supply system, rather than the other way around, and the Polaris support system is being planned along the same lines—to fit the existing Navy supply system. The trend pointed up by these two highly successful development programs appears obvious—while a weapons system type development arrangement works well, it is the existing Navy supply system which can best offer the new systems continuing and reliable support.

Col. Charles H. Roadman, USAF (MC)

Chief, Human Factors Division
Office, Deputy Chief of Staff/Development



WHEN Scotty Crossfield climbs into the X-15 some time this summer to send it through its first free powered flight, one team of men on the ground is going to be far more interested in how he behaves than in what happens to the airplane.

They call themselves the Air Force human factors group, an outfit which has no peers in the field of aviation and space medicine. One of the men most responsible for this distinguished Air Force reputation is a modest young (44) colonel named Charles Harvey Roadman, M.D. His job: chief, human factors division, Deputy Chief of Staff Development's office.

In simplest terms, this means he's a top manager in Air Force human factors research, runs a show whose broad concern is man in the Air Force environment. The job covers three major areas, each pretty big in itself—aviation medicine, training, human engineering.

Requirements needing human factors research can generate just about anywhere in the Air Force—from airmen, the commands, Air Research and Development Command. Roadman's office weighs all these projects for priority (which do we need to do first), then sees that as many as possible are given the resources (money, facilities, people) to assure adequate support.

Not only does he backstop the human factors research efforts in all of ARDC's labs and offices, he also monitors the same work at the Air University's School of Aviation Medicine and the Alaskan Air Command's Arctic Aero-medical lab. The job is not a simple one. But Chuck Roadman carries an impressive list of credentials for getting things done.

Second in a family of six children, Roadman was born in Waterloo, Iowa, the son of a Methodist minister-turned-college-president (of Morningside college in Sioux City).

Since he was first old enough to think about such things at all, it has never occurred to Roadman that he would become anything but a doctor. (His mother still treasures a bunch of doll "cadavers" he regularly cut up and sewed back together, performing imaginary surgery. He was the only

boy in Sioux City who could ask for a doll for Christmas and not start his father worrying.)

Roadman earned his medical degree at Northwestern University in Evanston, Ill., interned at the Baylor university hospital in Dallas, Texas. While there, he signed two documents which, it turned out, were to chart his entire future. One was a marriage license, co-signed by Ann Hoover, a pretty Braniff airlines hostess he met on a blind date in 1940, married a year later. (They have two children, a 17-year-old daughter and a 15-year-old son, and Ann Roadman, as interested in aviation medicine as her husband, is currently president of the wives' wing of the aero-medical association.)

The other document: 1940 enlistment papers in the Air Corps reserve. The only intern at Baylor who did not belong, he joined "mostly to go along with the crowd and, not knowing much about the military, the Air Corps seemed the coming thing." He promptly became fascinated with aviation medicine and, just as promptly, decided if he was going to be any good at it, he'd have to find out what pilots do.

He began haunting the flight line at Randolph Field day and night, hitching rides whenever he could, eventually got Air Force permission (with one other man) to go through flight training, became the Air Force's first flying doctor. (Even today there are only 15 or 18 such men.)

He left the service for private practice, as an obstetrician, in 1945, was back one year later. His reason: "I couldn't stand seeing all those airplanes going over and not being part of it." He admits, however, he got an added push from delivering 78 babies in the one month before he returned to active duty.

A line officer for 13 years, Roadman earned his command pilot's wings in August 1957 (another Air Force first for a doctor), was picked for his present job after a tour at the Air War College. He holds the highest board certification in aviation medicine, probably knows as much as or more than any other Air Force officer about the human problems of space research—and has had to work hard to keep

up with the demands of being a top-notch doctor, pilot, scientist, line officer and administrator.

In his present job he places great store by good management but gives short shrift to the men who try to substitute it and/or research for decision making. "Research is not a substitute for decisions and management is no substitute for judgment. If we would use a little more common sense, we could vastly improve the management of our research programs."

Most publicized human factors research area is, of course, marrying man and the machine—although this is really only the final tie-in. The goal in this man-machine marriage: mate the man-machine complex so they are compatible in mission accomplishment.

What about space flight? To Roadman, and the other men in human factors, the protection and performance of man in space are the big question marks. "We don't know yet just what he can do."

The X-15 is a big step in this direction. The four to six minutes of weightlessness it will provide (during which the man will have to be performing tasks) are far better than the 40-45 seconds Air Force researchers have been able to attain up to now. What weightlessness will do to the crew is the largest area of uncertainty. Says Roadman, "We feel they can handle it. The X-15 is a start but the scientific answers, of course, are going to come only when we put a man up for 12-24 hours."

"There are plenty of problems," he adds, "on the X-15, but we feel they can hack it. Our big advantage is that Scotty Crossfield and the other pilots have grown up with the thing, have confidence in it. They wouldn't get in it if they didn't. Although they are a different breed of cats, living on the edge of danger, they aren't flying fools. There's a tendency to over-glamorize these projects as relates to test pilots."

In the space race, many scientists have privately voiced the opinion Russia will beat us there with a man. Some in fact, infer that they have probably already tried. Said one: "It all adds up. They have the equipment to do the job right now and they certainly wouldn't lack for volunteers. That they haven't said anything is no reason to believe they haven't tried. Their pattern is to publicize their successes, clamp a tight lid on their failures."

Roadman seems to assess the race about the same way. "They'll probably get there first," he observes, "because they appear willing to take a much greater risk. We're not going to send a man up until we're pretty darn sure he's coming back."

ARMED FORCES MANAGEMENT

The Logical Approach to Problem Solving

While there is no easy way to solve a particular problem, there are certain methods that can be applied to almost any problem. Successful problem solving often begins with these methods . . .

Henry G. Mazlen

*Management Analyst Officer
Military Medical Supply Agency*

SCIENTIFIC measurements have established the fact that the successful solution of problems can be made a mental habit. By painstakingly examining our own thinking processes, we can discover our strong and weak points. By pinning down the specific ways in which we solve problems, we may develop means to improve our ordinary as well as our special abilities.

The most critical step in successful problem-solving is removing every element of vagueness and getting the exact definition of complexity. Where gaining the objective requires overcoming intermediate obstacles, each important in their own right, we may state the overall objective.

It is also important to know which answer will be satisfactory—general or specific. Suppose you wanted to reflect sunlight. Your immediate solution might be: "Get a mirror." This is specific. The general solution is to use any surface which reflects light. Such information is commonly obtained by experimentation. The extent to which such experiments are to be carried will be dictated by the problem. The specific answer was based entirely on experience. The very concept of a problem can take many forms and interpretations if we are not sufficiently precise.

Data gathering and processing techniques are closely related to concise statement of the problem. Where there is experience, data already exists. With no experience, data must be envisioned or developed. The latter effort requires more ingenuity, theorizing or experimentation.

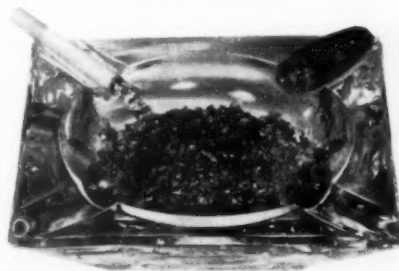
With the former, we must still search for directly related information. We must know our authorities so that all sources may be validated. The two questions arising are: (1) What information do we need? and, (2) Where is the information available? Get into the habit of being able to answer both completely. If there are many sources, each acceptable, you must determine which one to use—in the interest of economy of time and effort.

It is amazing how much can be ob-

tained by statistical techniques from an otherwise confusing mass of information. When you collect all data needed for the ultimate findings, you must make it manageable by summarization in tables and charts. Reducing quantified information can be done in many ways not requiring difficult mathematical concepts.

This does not mean mathematical

analytics should be avoided. When such techniques will contribute to the objective, qualified specialists should be on the problem-solving staff. The analytical statistician is not merely concerned with reducing masses of quantified data. Through the techniques he uses, he seeks practical applications which will have immediate, demonstrable utility. Statistical methods



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act to restrain mere accumulation of data.

In any decision there must be absolutely clear thought. Whether or not statistical methods are used, others will review our findings. In anticipation, we must conduct a completely impartial scrutiny of our conclusions. You cannot afford to guess. Suspend your judgment until that point when the evidence seems beyond dispute.

Get in the habit of examining facts prior to consolidation. Understand the limits of all assumptions. Remove all ambiguities. Should you attempt to

draw hypotheses from samples, leave no doubt on the validity of the data or the sufficiency of the sample. Avoid being dogmatic.

Teamwork in problem-solving requires delegation of responsibility with supervision over others and verification of results. Formulation of plans and assignment of technicians are themselves important problems on which success of a research effort may hinge. In selecting methods, you may decide to use scientific principles, theoretical concepts, statistical techniques, qualified assumptions, or combinations of

these. You may be responsible for selecting sources, collecting data, explaining to others why you used certain methods, interpreting findings and preparing reports. In complex investigations, you may have to divide the major objective, determine chronological scheduling and coordinate the inter-related portions. Your skills will develop as you assume responsibilities.

Objective evidence must support your opinions. With ideas—as well as basic data—you must segregate the significant from the irrelevant. By using only what is worthwhile, you will move as rapidly as possible. You will never be accused of indecision when solutions are long drawn out if you can show at each step you have gone as far as conditions permit.

With insufficient data to make decision, judgment must be suspended.

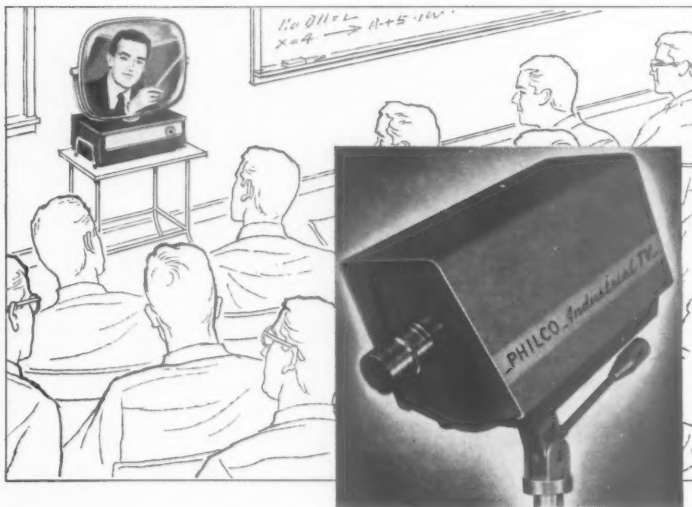
To avoid ambiguities, examine the entire problem. For example, "Is the land at the South Pole suitable for wheat farming?" An adequate answer requires that we analyze soil samples from the South Pole. The report may show that the soil is rich enough for wheat farming. Because the soil lies under tons of hard packed snow and ice, we must answer in the affirmative as well as the negative, for the reasons stated.

Within the Federal establishment, exceptional problem-solving ability is recognized under the following: (1) Developing effective methods; (2) Exceptional speed in determining such methods; (3) Keeness in reviewing procedures; (4) Recognizing inadequacies in current operations and as they develop; (5) making reliable forecasts resulting in effective economies of time, manpower, plant facilities or other resources and costs; (6) unusual individual contributions to developmental or applied research and problem-solving; (7) Recognition for outstanding contributions by professional organizations or other groups.

By progressive steps we add strength to old habits and create new habits in applying logical principles, knowledge, talent and imagination to an infinite variety of problems. Most great research moves forward on the contributions made by many workers. You must get into the habit of constantly encouraging associates and subordinates to think progressively. Key researchers provide leadership and coordination—but problem-solving is seldom a one-man show.

Practice in reflective thinking makes us critical of ideas; forces us to substantiate positive assertions; enables us to recognize that which is significant; provides us with new ideas and new directions. These are the keys to successful problem solving.

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Procurement Trends

PROPOSALS FOR A NEW TACTICAL AIR COMMAND AIRCRAFT are running the Source Selection Board gauntlet. Plan would be to modify an existing aircraft for strike and reconnaissance missions. Being considered are A3J, B-58, F-101, and F105.

ONE-MAN HELICOPTER LOOKS GOOD TO THE MARINES, after checkouts run recently at Quantico. Army may be next to follow the trend, has long wanted small craft of this type for reconnaissance work, battlefield liaison.

CONGRESSMEN PROBING PERSHING DEVELOPMENT PROGRAM—because the arsenal system wasn't used—are going to find themselves up against tough arguments. While arsenal system worked well on Redstone and Jupiter, Martin is working closely with Army, has initiated a program of "concurrent development" to bring the Army in. Because of this concept, overall development time will probably be cut on the missile.

COMPETITION TO REPLACE THE P5M IS IN THE AIR in the Navy. While the competition has been in the talking stage for some time, it should not be too much longer getting underway. What Navy wants: greater range, less cost, greater speed. Specifications have gone to BuAer, which will prepare competition proposal.

REPERCUSSIONS IN INDUSTRY MAY RESULT FROM NEW DOD RESEARCH SYSTEM, according to views expressed by Dr. Herbert York, the new Director. Said York, "more research . . . less production." His remarks tie in with statements by Army Researcher Maj. Gen. J. B. Medaris: "There are too many people in industry who want to make a career of one project." The new policy will mean greater risk for industry, but better products for defense.

BECAUSE THE WEAKEST LINK IN ANY NAVAL OPERATION IS LOGISTICS, Navy is looking closely at the possibility of underwater supply storage. Idea would be to plant supplies in quiet times, pick them up as needed at later dates. The same 1953 study that made this suggestion called for underwater cargo ships—on this one, no results to date.

RENEGOTIATION ACT PROBE, another of Congress' long-promised investigations, is now likely to be delayed another month. Even though Administration has not yet formally handed Capitol Hill its request for extension, Ways and Means committee thinks it may have to replace RA at top of the agenda with unemployment compensation needs.

STRONG DEMANDS ON CAPITOL HILL, countered by procurement pussy-footing, make Army general Taylor's cries for a modern Army hard for Congress to swallow—much as they'd like to. Latest example: asking bids on 4000 M-151s, a follow-on to WWII's Jeep. Contract's estimated final worth: \$40 million. Both House and Senate appropriations committees have made their opposition clear. The argument: "The Mechanical Mule (and its counterpart with seats) already has operating forces endorsement. (Marines in Lebanon used it instead of the Jeep.) Yet only about 1000 Mules are in the inventory—all of them in "tomorrow's" units like USMC, STRAC. M-151 is little more than a Jeep with softer cushions. If you're so hard up for modernization money, why keep trying to buy last year's equipment?"

ARMY'S ONLY COMPLAINT, and a vague one at that, with the Mechanical Mule may be solved in the not-too-distant future. The gripe: in spite of its excellent overland performance, the Mule is too slow to keep pace on the highway. The solution: Kaiser-Willys has developed a similar vehicle which can cruise at 50-60 mph on the open road, sacrifices little of the overland advantages of the present Mule.

Procurement Trends

Improved Management Will Cut Lead Times

Management is the least understood and recognized factor in reducing lead time on weapons projects, according to Maj. Gen. B. A. Schriever, commander of Air Research and Development Command's Ballistic Missile Division.

Schriever last month told the Western Space Age Conference that combinations of courage and scientific, technical and executive skills are hard to find. But, he said, both public and private business now demands these qualities which are shaping the management pattern of the future.

Executives need not be scientists or technicians, he said, but they must acquire a working familiarity with today's problems, and evaluate the scientific and technological implications and their meanings in production lines and markets of the future. Management leaders must develop executives with a grasp of scientific and technical problems, plus scientific and technical men who understand management problems.

Schriever said the extent to which this is done will guide growth and prosperity of individual enterprise and free economy. He said this was one of the most important lessons learned in the guided missile program.

Renegotiation Act Hit, Changes Introduced

Many "infirmities" in the Renegotiation Act were the target of a speech and the recently introduced bill of Rep. Cecil King (D-Calif.) before the House.

King conceded that the Renegotiation Act is still needed, but he said that "the contracting procedures within the government are not adequate to prevent the accrual of profits beyond those contemplated by the parties in most cases." It is necessary to guard against "windfall" profits, he said.

But, he added, it is morally wrong for the government to contract in good faith and years later, after performance has been completed, to permit the Renegotiation Board to change the contract and recover profits fairly negotiated in the first place.

King's bill calls for two-year extension of the Act, and would (1) require the board to consider financial stability and incentives in the defense industry and desirability of comparing costs and profits of defense industry with other industries; (2) preserve

the integrity of contracts negotiated with the government by rendering—subject to renegotiation—profits in any year which exceed by more than 10% a portion of the profits contemplated by the parties; (3) give to Congress, the public and the parties effected more information on the reasons for the board's decision and the results of its findings in major cases and (4) provide for appeal from Tax Court decisions in renegotiation cases.

Missile Management Setup Told by Navy

There have been a total of 440 prime contracts awarded for the Polaris missile and submarine system, according to RAdm. W. F. "Red" Raborn, head of Navy's Special Projects Office. Raborn has told Congress that contracts for the missile system itself number 140.

The remaining contracts are connected with the submarine or "transportation" of the missile. Although detailed figures are classified, Lockheed Aircraft Corp. holds the largest, totalling "hundreds of millions" of dollars.

Witnesses told the House Military Operations Subcommittee that there are four means by which missiles are developed in the Navy, with Polaris itself comprising one of the systems.

First of the remaining three was used on the Talos missile. Talos was developed under the direction of the Johns Hopkins Applied Physics Lab,

with systems engineering—pulling together all elements—handled by the Vitro Corp. Sidewinder was developed "in-house" by the Navy. The final means is shown with the Bullpup, which was under the "broad technical responsibilities" of The Martin Co.

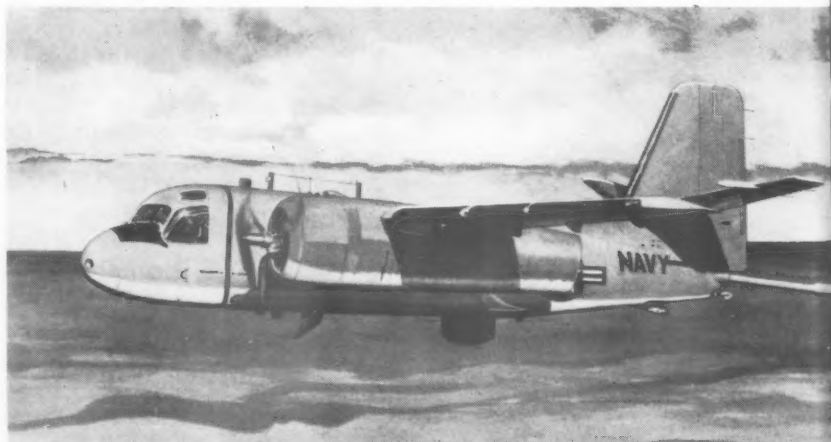
Missile Logistics Up, Gen. Funk Reports

Military Air Transport Service C-124 and C-133 aircraft have hauled some 8400 tons of Thor equipment—including complete missiles—to England in the past ten months. By the end of January, 99% of needed Thor spares were stored in England at the first Thor site, according to Maj. Gen. Ben I. Funk, commander of Air Materiel Command's Ballistic Missile Center has said.

Funk also said that organizational buildup in Atlas logistics is moving forward, and added that he is confident that support will be available for Vandenberg AFB squadrons becoming operational this summer. He said Titan spares were also being provisioned. Minuteman logistics program was presented to AMC last month, but operational plans have not been finally approved.

Competitive Bids Aimed for in Bill

Legislation which would require the government to buy defense goods and other wares on a "strictly competitive basis" wherever possible has been proposed by Sen. John J. Williams (R-Del.) Williams said his bill would "unquestionably save millions



Grumman S2F Tracker is first anti-submarine aircraft to combine hunting and killing characteristics. Plane can operate from carriers, is manned by a crew of four. Modified version shown here will embody several improvements.

of dollars annually for the American taxpayers."

Williams said the bill stemmed from GAO reports that millions of dollars were wasted because contracts were negotiated rather than awarded on a competitive basis. Williams said his bill "provides that the contract must automatically be awarded to the lowest responsible bidder, with exceptions being made only in those instances where the advertisement for bids would not be feasible from a national security standpoint."

In proposing the bill, Williams cited a GAO report which said that Navy failed to use adequate cost data in a contract with McDonnell Aircraft Corp. Similar bills have been introduced on the House side by Reps. Carl Vinson (D-Ga.) and F. Edward Hebert (D-La.).

New Rules Established For Materiel Studies

New rules for preparing materiel planning studies have been set up by the Secretary of Defense in DOD Directive 4200.1. The new directive will ultimately provide a uniform presentation of requirements and assess data for supply planning, budget preparation and funding.

The studies are also intended to permit procurement and production planning for supporting peacetime and mobilization programs; coordinated review by the Defense Secretary; interchange of demand and supply information between using and procuring agencies of the military departments; scheduling of rebuilt operations; determination of supply availability for peacetime and mobilization; determination of a realistic relationship between current and mobilization programs; and identification of problem areas.

Studies will cover a selected list of principal items as determined by the Assistant Secretary of Defense (S&L) in cooperation with other elements of the Defense and military items. Also, studies are to be submitted to provide justification for apportionment and budget estimates.

Defense Revises Rules On Production Equipment

Defense Department has again changed rules on retention and maintenance of production equipment. The new rules are contained in DOD Instruction 4215.1, and apply to production equipment retained by the military departments to support combat readiness, their phased expansion, and

the production rates that will satisfy combat replacement or consumption needs.

Generally, Defense Department will continue to retain the production equipment needed for an industrial base sufficient to support the strategic concepts approved or issued by the Defense Secretary. Minimum equipment quantities will be maintained.

Retained equipment will normally fall in to package plant, standby line or base package categories. The need for keeping the equipment will be re-evaluated each two years.

Small Business Percent Of Defense Work Drops

The percentage of government business that is going to small business has continued to drop, and "there is no indication of any improvement," Rep. Abraham Multer (D-N.Y.) has charged. Multer made no mention of the dollar volume that is going to the smaller firms, which has actually risen during the same period.

As chairman of a special House Subcommittee on Small Business and Government Procurement, Multer will head an investigation designed to find ways to improve the methods with which government procurement programs are conducted. Congressional sources say the hearings will result in proposed legislation on small business practices.

Multer said the hearings would stress protection of proprietary rights for small businesses in development work, and the continued use of negotiated procurement. The House group will also investigate restrictive language in specifications prohibiting equal opportunity for small companies.

Extraordinary Power Set in New ASPR

Rules needed to permit "extraordinary contractual actions to facilitate the national defense" are contained in Revision 43 of the Armed Service Procurement Regulation.

The section was written into the ASPR following enactment of Public Law 85-804, successor to Title II of the First War Powers Act, and the issuance of Executive Order 10789. The order gave to the Secretary of Defense authority to take extraordinary contract actions for the President.

The new section provides for making, amending or modifying contracts without consideration, to facilitate national defense, and for the formalization of informal commitments made by the military departments, and for correction of mistakes. The section only applies in national emergencies.

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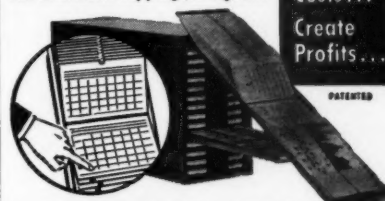
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Research Rundown

NAVY'S RAT ANTI-SUBMARINE MISSILE WILL BE READY TO GO in a year, but won't go anywhere. Sources say there is little chance that the ship-launched weapon will ever go into production. The reason: by the time RAT is ready, Navy will have both submarine launched rockets and submarine launched anti-sub torpedoes which pack the same punch as RAT, have greater range and accuracy.

LEAD TIME ON NEW MANAGEMENT IDEAS, while not as publicized as the lead time on new hardware, is in as bad shape. In Navy's Special Projects Office, where new ideas are SOP, one officer estimates that the average waiting time—from first conception to adoption—is in the neighborhood of ten years. By cutting this lead time, and using the best ideas at hand, Special Projects has managed to cut nearly four years from original estimates on completing Polaris.

ATOMIC POWER IS HANDLING A GROWING JOB IN RESEARCH WORK, not on its own, but in support of other programs. Two applications in the planning stage both concern The Martin Co. First of these would send small atomic generator into space for research purposes, second would take larger size reactor to Northern Greenland for work in arctic research. Reactor in Greenland would enable research teams to maintain year-round operations on ice cap, where formerly work was done during a four month season.

MAJOR CHANGES IN AF AND NAVY RESEARCH SET-UPS should be implemented soon. Air Force will wait until new commander is named for ARDC before changes are announced. On the Navy side, more rank and more authority will be given to RAdm. J. T. Hayward, when he becomes Deputy Chief of Naval Operations for Development with VAdm's rank. Navy tipsters say the new job will mean that Hayward is virtually in charge of all Navy R&D—his dynamic personality and will to get things done should give him this control.

MODIFICATIONS IN AF'S WORKHORSE C-130 ARE IN THE OFFING. Aim is to make the mammoth plane an STOL craft. Changes would involve adding turbojet engines to the Hercules, along with boundary layer control for added lift. Testbed version of the modified plane is under development at Lockheed-Marietta.

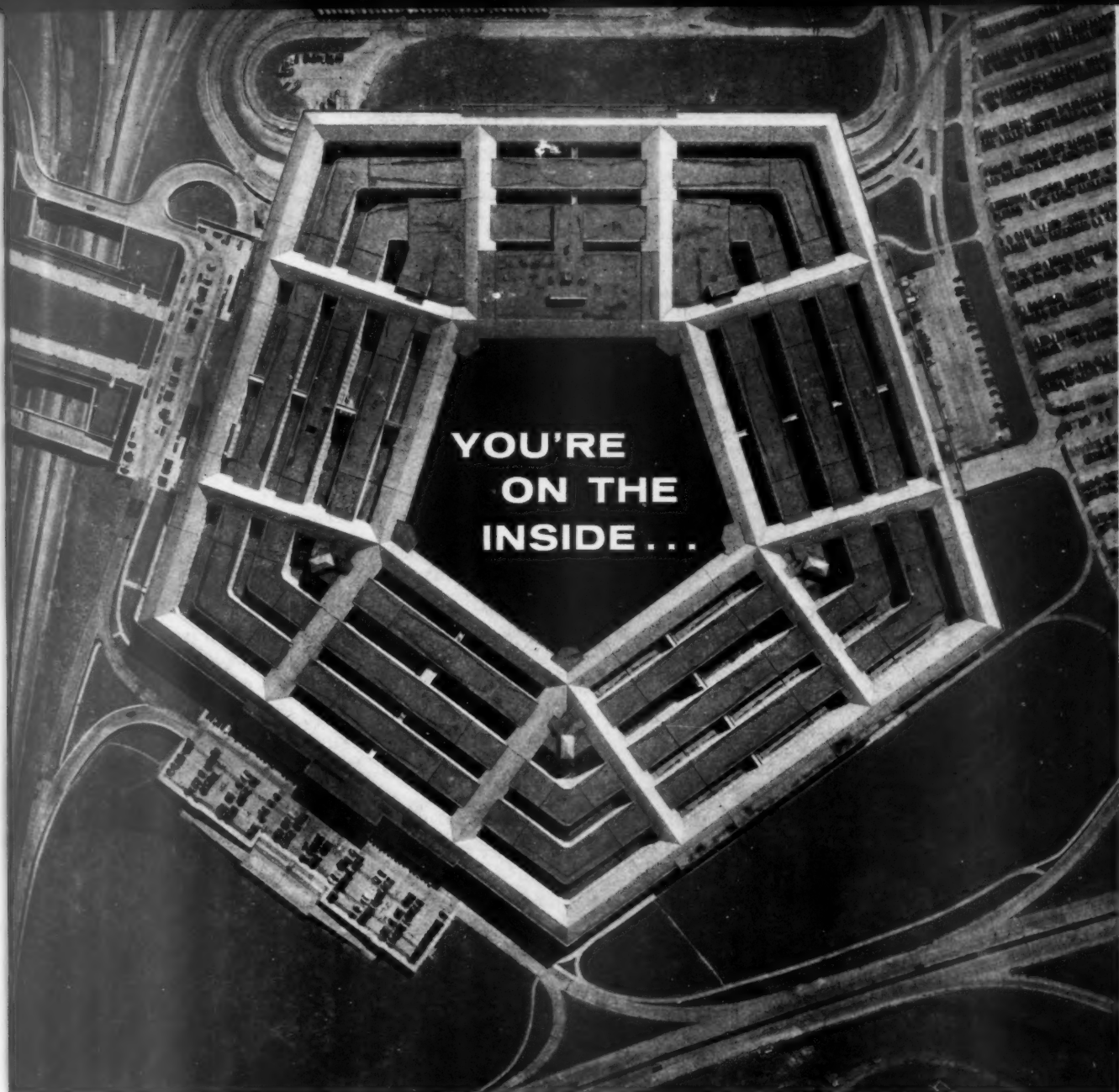
SUCCESSOR TO THE WF-2 RADAR PICKET PLANE is under development at Grumman Aeronautical Engineering Co. The new W2F-1 will be powered by twin Allison T56 turboprop engines, will have more range and speed than the WF-2, will still be able to operate from carrier decks.

"LITTLE JOE," A CLUSTER OF FOUR SERGEANT GUIDED ROCKETS will play an important part in the early phases of National Aeronautics and Space Administration's Project Mercury. Shots will be fired from Canaveral or Wallops Island, information will be used to put man in space.

NAVY HAS HOPES POLARIS WILL BECOME OUR BEST ANTI-MISSILE MISSILE DEFENSE, as well as an effective retaliation missile. Idea would be to place missile carrying subs across Arctic along known routes Russian weapons would have to travel to reach prime-U.S. targets, give us a much wider margin in allowable reaction time.

SPEAKING OF POLARIS, LITTLE-NOTED ASPECT IN ALL THE CONVERSATION ABOUT WHETHER it or Minuteman is going to be better is that Minuteman's technological success is dependent right now to a large extent on how well Polaris develops. In present time frame if Polaris hits a snag, Minuteman, too, will have to back up its development schedule.

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Research Rundown

Minuteman Progress Noted by Irvine

Air Force may accelerate the Minuteman solid propellant ballistic missile program by as much as six months, according to Lt. Gen. C. S. Irvine, deputy chief of the air staff (materiel). Irvine said "The Minuteman program is doing very well, indeed it is ahead of schedule."

At the same time, Air Force has announced formalizing two contracts for \$162 million for research and development on the three stages of the advanced weapon. Contractors involved are Aero-Jet General and Thiokol Corp.

Thiokol will work with the first stage, and Aero-Jet will handle the second and third stages.

Component Development Stressed by Hayward

Greater emphasis on component development and less on weapons systems reaching far beyond the current state of the art would be one key to better program management—and corresponding progress in the technological battle with Soviet Russia—according to RAdm. J. T. Hayward, assistant chief of naval operations for research.

Hayward has said that 60% of the Navy's R&D money should be spent in this area. If this were done, when a weapon was required trouble areas would be cut to a minimum. Hayward said that the Nautilus was a case in point—the nuclear power plant was mated with a conventional submarine hull, rather than with an entirely new weapons system.

Hayward said that better program analysis would alleviate many of the problems in this area. This step would determine early the risks inherent in new program. Hayward pointed out that National Aeronautics and Space Agency is using this system with marked success.

Failure to use this approach, he said, is one reason for the delays in the nuclear aircraft program. He also said this was one cause of Vanguard's failure.

Army Research Chief Wants Lower Lead Times

The need to reduce development lead times to a four year maximum is critical, according to Dr. William H. Martin, Army Chief of Research.

The means to this end, he said, is "the use of an organization pattern which permits concurrency in the consideration of various related and diverse interests so that interactions can be treated simultaneously instead of serially . . ."

Martin said he wanted a basic research and component development program of sufficient scope to permit a reservoir of new knowledge, concepts and components; a well drawn project plan for development; extension of the development cycle into the production of the first lot until a working item has been built and tested.

Martin also saw the need to put responsibilities for development, preparation for production, initial production and support material in a single contractor. He called for using military characteristics when possible throughout the development program, placing primary responsibility in the Army R&D agency for adjustments needed through lack of experience in technology, and economical quality production, reliability and availability.

Finally, he wants an even flow of financing to permit the four-year development cycle to go ahead without stops and starts.

SCAR Navigation System Described by Navy

SCAR—Submarine Celestial Altitude Recorder—is a navigation system

which permits submerged submarines to determine their position from the stars, according to a recent announcement by the Navy.

Mounted in a submarine's periscope, SCAR has been used on the extended underwater voyages of the Seawolf, Skate and Nautilus. Cdr. William Anderson, commanding officer of the Nautilus ranks SCAR with "development of the snorkel and the new Albacore submarine hull design."

A celestial fix can be taken with SCAR at periscope depth, and results of the fix are computed by the system. SCAR gives the submarine commander his angle of sighting and the exact time on a printed piece of paper. Development work on SCAR was handled by Sperry Piedmont Co., a Division of the Sperry Rand Corp.

Medaris Comments On Missile Work

A "certain proportion" of Army's development work must be done under the in-house approach rather than the arsenal approach, according to Maj. Gen. J. B. Medaris, Commanding General, Army Ordnance Missile Command. The reason, he said, is to control final quality, and gain engineering knowledge.

Medaris told the House Military Operations Committee that "with all faith one could have in the performance and patriotism of the industrial

This VTOL wind tunnel model uses both tilt-wing and deflected slipstream principles for verticle and horizontal flight. Powered electrically, it is presently being tested at NASA's Langley Research Center.



Army Plans For New VTOL Craft

Work has been completed on a single large scale wind tunnel aircraft model, combining the deflected slipstream and tilt-wing principles of vertical take off and landing. Work was done by Vertol Aircraft Corp. under a \$227,000 Army contract.

The model has been delivered to

National Aeronautics and Space Administration's Langley Research Center where it will undergo extensive tests. Information sought in the program includes such items as wing and propeller efficiencies, control effectiveness and aerodynamic loading.

The model has a 35-ft. wingspan, length of 27 ft. and gross weight of roughly 14,000 lbs. The wing mounts six propellers, driven by a 1000 hp electric motor located in the fuselage.

ARMED FORCES MANAGEMENT

segment of the United States, we must understand that in industry the manager is necessarily subject to a certain division of loyalty." With the military/civilian team under the arsenal concept, he said, Army "can retain objectivity which is not always available in private corporations . . ."

Medaris added that Army was not failing to use U.S. industry, but rather it was spending "almost all" of its money with industry.

In further testimony, Medaris admitted that the Plato anti-missile-missile project was dropped only after \$18.5 million had been spent on it. The decision, he said, was based on budgetary considerations. He added, "I agree that the proper decision point is before you put money into it. Things like this give me a frustration that there ought to be a better way to run a railroad, but there isn't."

Industry Developments

Space Flight Trainer Proposed by Northrop

The Northrop Corp. has made a proposal for the first training aircraft for space age pilots to Air Force, Advanced Research Projects Agency and National Aeronautics and Space Administration. Although Air Research and Development Command has expressed interest in the project, it is probable that their budget will not allow them to look into it in detail.

The space age trainer would be based on the T-38 twin jet trainer which Air Force currently has in its inventory. The modified T-38—called N-205—would be powered by two liquid rocket engines instead of the jets. Only 25% modification would be necessary, according to Northrop, including heat resisting materials.

Top speed on the rocket powered craft would be Mach 3.2, but the N-205 would be capable of ballistic flight to altitudes up to 200,000 ft. Pilot and instructor would experience weightlessness up to 150 seconds. Reentry would be done at 150,000 ft. at a speed of Mach 1.3.

Pershing Missile Work On Accelerated Basis

The Martin Co. has announced that development of the Pershing selective range solid propellant ballistic missile is proceeding on an accelerated basis. The reason for this, say company officials, is use of a new concept in missile development.

Under the new concept, both Army and industry testing programs are being carried out concurrently, rather than consecutively, as in the past. Says Maj. Gen. J. B. Medaris, by the former method, "the developer, within the limits of his technical knowledge, produced a weapon system which then was turned over to the Army for testing, and later returned to the prime contractor for modifications dictated by the Army prior to final release."

Under the new system, such steps in the development program as engineering test firings and Army test firings are scheduled concurrently. In further attempts to speed the program, Army troop trainees will be used in the test firings of the missile. Also, logistics and ground equipment are being developed along with the missile itself.

Megaboom Rocket Developed for Sleds

Off-the-shelf selection of controlled energy solid propellant test sled rockets for field loading is possible through using a modular design concept incorporated in the Megaboom rocket motor, developed by Astro-dyne, Inc.

The modular design concept theoretically makes possible sled rocket motors ranging in thrust from 6,500 to 500,000 lbs. in durations from 3.5 to 15 seconds. Various nozzles and propellant bundles would be available. Designs supplied by the contractor would permit the correct selection of propellant, charge weight and nozzle design.

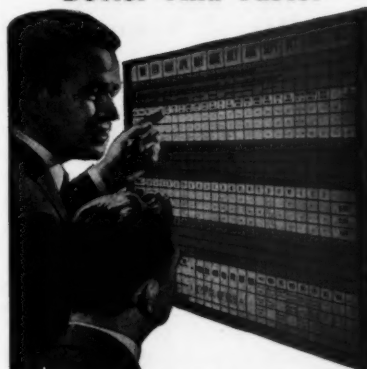
The concept has been used successfully in such programs as the XM-34 booster unit, used to zero-launch the F-100.

New Ejection Seat Gets Rocket Assist

Talco Engineering Co. has announced development of a new rocket-assisted personnel ejection catapult for military aircraft. The unit was demonstrated for military and industry representatives late last month.

The seat operates either at altitude or ground level. It combines a cartridge actuated system for initial propulsion with a rocket which takes over after the seat is separated from the aircraft. Successful tests have been run from aircraft traveling more than the speed of sound, and from stationary aircraft.

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Personnel Preview

AMC Payroll System Partially Mechanized

Air Materiel Command has developed and implemented, through its Ogden (Utah) AMA, a mechanized payroll system, using the high-speed calculating and self-checking features of the IBM 650 Magnetic Drum Data Processing Machine.

The mechanized payroll system computes the monetary payroll and leave data processing.

The entire pay and leave record for each employee is mechanically prepared on a biweekly leave and earning statement, and distributed with the employee's paycheck. All possible pay sources and deduction identifications are shown on this statement, plus amounts of leave used during the pay period and leave remaining.

The system divides the computations into a leave run and a pay run. The employee's leave used and leave accumulated are computed, and the computer makes various leave decisions, such as changing annual leave to leave-without-pay when the employee's leave balance does not cover leave

charged. These decisions are mechanically listed and submitted to the payroll office, where the decisions are audited before the pay run to insure compliance with regulations.

During the pay run, the employee's net pay is computed, considering his salary, hours worked, awards and all deductions. From the output cards generated, all pay products are mechanically prepared, including checks, leave and earning statements, savings bonds, TD Forms W-2, Individual Pay Record Cards and payroll reports.

The pilot installation with a payroll of about 11,500 employees reported annual reduction in payroll processing costs of approximately \$20,000. This reduction was in personnel costs, offset to some extent by the increase in machine processing costs. Other gains were evident which could not readily have a dollar value placed on them. Reduction in costs available through this system will vary, dependent upon the number of employees serviced, the number of payroll office personnel, and local variations in payroll processing.

Vaughan Named to Head Legislative Affairs

George W. Vaughan has been named Assistant to the Secretary of Defense for Legislative Affairs, replacing Maj. Gen. C. J. Hauck, who formerly held the position in an acting capacity.

Hauck will remain as Deputy to Vaughan. Reason for the change appears to have been pressure to have a civilian in the top spot in Legislative Affairs.

Another change—in the Army Secretariat—will follow the retirement of Frank Higgins, Assistant Secretary of the Army for Logistics. Higgins, who has held that post since 1954, will be replaced by Courtney Johnson. Johnson was formerly Deputy to Higgins.

Top Research Posts Filled at Pentagon

Dr. Nicholas E. Golovin will take over as director of the Technical Operations Division of Advanced Research Projects Agency this month. Golovin was formerly chief scientist at White Sands Missile Range, N.W.

Golovin will be responsible for the day-to-day management of ARPA programs. The new division was formed to handle the increasing number of

highly complex problems with which ARPA must work.

Another ARPA appointment—Chief Scientist—has gone to George P. Sutton, who will replace Director of Defense Research and Engineering Dr. Herbert York in that post. Sutton will also take over as director of the Advanced Research Projects Division of Institute of Defense Analyses.

In the recently created Directorate of Defense Research and Engineering, Hector R. Skifter has been named Assistant to the Director for Air Defense (see p. 14) and Howard A. Wilcox has been appointed Deputy Director.

Weather Service May be Up-Dated

Space age tasks—and a new name reflecting them—may be in the offing for the Military Air Transport Service Air Weather Service, says Maj. Gen. H. H. Bassett, AWS commander.

Possibility for the new name would be Air Weather and Astrophysical Service, said Bassett. He added that the redesignation would not take place until 20-25% of AWS manpower is devoted to geophysical activities.

Bassett stressed the increasing importance of his command's work in the future, and mentioned plans to add east- and west-coast terminal forecasting areas to the central facility already in operation. He said that in the future, automation and centralization of activities would play an important part in the role of his command.

Dr. Hill, IDA Official, Receives High Award

Dr. Albert G. Hill, Vice President and Director of Research for the Institute of Defense Analyses, has received the Meritorious Civilian Service Award "in recognition of his many contributions to the Defense program and the national security."

Hill—on leave of absence from Massachusetts Institute of Technology—had worked for two and a half years as Director of Research with the Weapons Systems Evaluation Group before taking his present job.

In part, the citation reads "Dr. Hill . . . has carried on a succession of duties which have contributed immeasurably to the solution of major problems in the defense of the United States and Allies . . . His broad vision, technical competence, sound guidance and selfless dedication to the tasks to be done have been of outstanding assistance in the development of military security policies."

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Newsletter

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Phone: OTis 4-7193

National President: Rawlings S. Poole

Executive Director: VAdm. Harry E. Sears, USN, ret.

Program

Why do we have chapters; what is their purpose? The AFMA chapters main purpose is to further the objectives of the Association—principally the exchange of management knowledge—at the local level. Further, it is designed to render unique service to the installation upon which it is located, while providing to the membership professional knowledge and a community of fellowship in a field of common interest. Thus, it serves the installation, helps to educate its people and make them management improvement conscious, provides a natural liaison with industry in the area, and builds morale.

How do you go about forming a chapter; what's the procedure? This is a query we are receiving with increasing frequency in National Headquarters. There is nothing strange or mysterious about this, nor does it require an act of Congress! As a matter of fact, we do everything we can to make the process as simple as possible, and once formed, to make chapter administration as easy as possible on those who had the initiative to write in about details. Boiled down, the main ingredients are *interest* and *support*. The interest of a dozen or so management minded people (the minimum number we have found to develop a worthwhile program), and the support of the commanding officer. In the latter connection, we have yet to find a CO, when fully apprised of what a chapter can do to help him in carrying out his mission, fail to lend his support to this worthy endeavor. A request to AFMA in Washington on the part of the person desiring to form a new chapter, will bring a speedy response in the form of a chapter kit with full instructions, sample programs and administrative details. Once organized, chartered and operating, the services the chapter can render, and the enjoyment its members can derive, from its program, are limited only by the initiative and ingenuity of its guiding lights.

Chapter Briefs

Far East Chapter. This unique chapter, due to the far flung nature of its elements, has gone into monthly area meetings with periodic meetings for the full membership to be held at the "home base," Tachikawa AFB. Area memberships are located at Fuchu, Zama, and Atsugi.

Atlanta General Depot Chapter at a luncheon meeting held on 11 February, heard Dr. Joseph M. Bosworth, Division Medical Director for Liberty Mutual Insurance Company (and BGen Army Reserve) speak on "Attitudes of People at Work." More than fifty members were in attendance.

Central New Jersey Chapter had as its guest at the February meeting AFMA National President, Mr. Rawlings S. Poole. He accompanied Dr. Edward G. Witting, Deputy Director of R&D for the Army, who made a featured presentation concerning the Secretary of the Army's Fellowship Program. Fellowship Award winner, Eldon Sweezy, Staff Assistant to CO, Diamond Ordnance Fuze Laboratory, Washington, also made the trip and

reported on the results of his research study project, "The Scientist-Manager."

National Capitol Chapter conducted a panel conference on 26 February in the Pentagon attended by fifty-six members and management guests from 31 various DOD organizational elements. Chaired by Mr. I. M. Greenberg, Dept of the Army (Personnel), the panel included Mr. Benton Bray, Staff Member, House Committee on Post Office and Civil Service, Mr. Madison Smith, Manpower Programs and Requirements Division, Dept of the AF, and Mr. James Lamie, Office of Civilian Personnel, Dept of the Army. Conference topic, "Are Civilian Grades in the Military Services too high?"

Watch next month for official program listing of AFMA Annual National Conference Listing. Theme will be "The Role of Management in the Collapse of Time," overall program will offer valuable information to those attending.

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LETTERS

(Continued from page 7)

efficiency of some of the better managers while preventing serious abuses by other less qualified managers), it is nevertheless inaccurate and unjust to discredit Civil Service for failures of the Department of Defense and hold Civil Service responsible for the creation of problems which are inherent in any large organization . . .

It is true, as Mr. Stonewall states, that Civil Service does not provide employees with some of the rewards of bonus or profit sharing as is common in industry. This does not, however, mean that such benefits cannot be added in the future. The past year has seen a number of enlightened management practices introduced (such as increased professional training for employees at government expense). Additional improvements can be obtained in the future by constructive, cooperative efforts of all who are seriously interested in improving working conditions . . .

What has contributed to the absence of job satisfaction? We do not believe it is the Civil Service system. We believe it rests with management itself. We believe it is localized in the

confused status that exists in the relationship of civilian to military personnel. Some vague concept of "military control" seems to require that each activity on a military installation, irrespective of how "civilian" its function, must have military personnel assigned to supervisory and management positions. As a result, civilian personnel are placed in "advisory," "deputy," or "supporting staff" positions and their experience and skills used only as they are transmitted to or through a military supervisor. The whole organization suffers as individuals attempt to carry out their responsibilities through layers of supervision now necessary to follow the chain of command.

What can be done to alleviate the problem? First, let's have a clear cut policy from Congress on the use of civilians in the Department of Defense. Something more specific than the generalities of DOD Directive 1100.9 are required.

Second, provide a program of education and assistance from DOD level to show how civilians can be most effectively used in the management for which Congress intends them.

Third, give the same recognition and credit to civilians as to military personnel. Let's accept the fact both in-

side and outside the Services, that civilians do exist as a vital part of the Armed Services.

Something can be done, and we believe it will. Too many loyal, patriotic, hard-working, and conscientious civilian employees are dissatisfied with the present operation which is something less than ideal. It is not too late to get help from this session of Congress if we all work together.

T. J. Stewart

President, Lodge 1721
American Federation of Federal Employees

Your February issue carried, on page 32, a letter by Mr. J. K. Stonewall under the caption "Civil Service: The Management Bogeyman."

While I haven't taken the time to express myself before, I feel I should tell you that the fine editorial policy of your magazine with its above average complexion and the frankness as displayed by the printing of Mr. Stonewall's comments, makes the reading of your monthly effort a distinct pleasure, and often a worthwhile one. Mr. Stonewall's comments touch upon a subject that is of great concern to the many citizens, both military and civilian, who are interested in the effectiveness of our government and its processes. . . .

Capt. H. W. Leiser, USN
Richmond, Calif.

A-Carrier Bouquet

. . . The article (The Case for the Nuclear Aircraft Carrier, March AFM) is a vivid and accurate description of the way we feel about the nuclear carrier, and attack carriers in general. It is evident that Mr. Borklund . . . did an outstanding job of reporting to assemble such a complete story in justification of our need for modern aircraft carriers.

Despite the rapid and effective action of Naval forces at trouble spots throughout the world in recent years, such as Lebanon and lately at Quemoy, there are still many who do not understand that we need modern ships to carry out our global responsibilities. This article will certainly be of great assistance in convincing your circulation of this need.

In the final analysis, a strong, modern Navy cannot be attained unless we have the support of the American people and the Congress. Your contribution in informing an important element of the public about the part the aircraft carrier plays in this wonderful Navy of ours is greatly appreciated.

VAdm. R. B. Pirie
Deputy Chief of Naval Operations (Air)

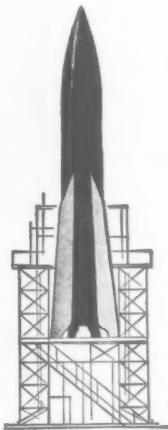
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Your Investment Future

WHY THE GROWTH OF MUTUAL FUNDS?

by W. Mac Stewart
(Financial Editor)

When future historians describe the second half of the twentieth century, considerable attention will be given to the rise and growth of mutual funds. Few industries have ever grown in the spectacular fashion that the fund industry has. In the past ten years mutual fund assets have increased by more than six times. There are now \$84 in fund assets for every man, woman and child in the United States. What is behind this tremendous increase in fund assets? Will this growth continue?

There are several reasons for the growth of mutual funds. Underlying all of them is the confidence of the American public in our economy. This is basic; without it, securities of any type would have difficulty finding a market. In the past 30 years America has experienced two wars, one depression and numerous recessions. In each case, the economy has snapped back to new levels. Our standard of living has continued to grow with the nation. Even after you allow for inflation, the average wage earner today makes 27% more money than he did in 1948. In short, the economy has been tested to the hilt and has completely justified itself to the public. Today a growing number of people are eager to share in the fruits of this economy through investment.

Along with this confidence is a greater understanding of the part that American industry plays in this nation. Our economy has long ceased being agricultural. But only in recent years has the general public become fully aware of this. Business, and especially "big business" was something mysterious. And there was a great deal of misunderstanding on the part that business played in our economy. Through advertising and educational programs, American industry has told its story. And the public has responded. In the past few years many newspapers have doubled the size of their financial sections because of the upsurge in public interest in business.

Finally the public has greater confidence in securities. Public opinion polls show that earlier distrust of securities is vanishing. Investment records tell the story. Years ago only a small part of the public invested in securities. Those who did were in the upper income brackets. Today nearly 9,000,-

000 people invest. And the larger percentage earn less than \$7,500 yearly.

There are two more reasons why the growth of mutual funds has accelerated so sharply. They both boil down to two conditions never before experienced in America. People are sending their children to college at an unprecedented rate. Our competitive society makes it almost a must that a youngster receive a college diploma. On the other hand, college costs are climbing along with everything else. Next to the purchase of a home, this is the largest expenditure that most people ever make. Anticipating this, more people are turning to mutual funds. It is difficult to estimate, but it is probably a conservative guess that the American public is investing \$300,000,000 in mutual funds yearly for educational purposes alone. This figure should continue to rise.

Another change in American living is responsible for some of this growth. People are living longer. Not many years ago, retirement was not much of a problem. But retirement today is a long-term proposition. There are many who live 15 or 20 years after retirement. Even the most generous retirement program does not allow more than half pay. Military retirement, which is one of the best, allows a man to retire at that figure. But this does not allow a retired officer to have the retirement which most people want. Living costs continue as before.

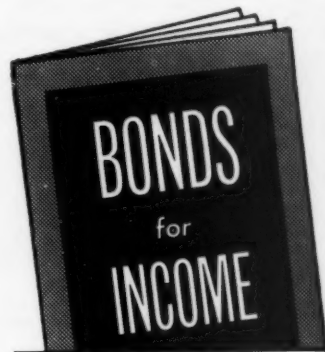
For this reason the American people are investing a fabulous amount of money in funds for retirement purposes—\$400,000,000 every year.

Well and good, you may say. But we have seen a time when the market has risen at a better-than-average rate. What about the future? Many economists have asked this about mutual funds. Funds have done well in the past, but how will they do in a declining market? This will be the true test.

People today do not regard mutual investment fund as a short-term investment. They regard it as a long range savings program. They are used to the idea that the market will fluctuate, and they are not terrified by dips. Instead of watching market performance today, they are looking to the future, when they will need money for some major need—such as education or retirement.

Instead of being a short-term phenomenon, most authorities agree that mutual funds have now become a vital part of the American economy. Their appeal to people in all income levels

promises to grow even stronger. During the next six years, many expect fund assets to reach \$20 billion. There is every indication that the mutual fund is here to stay and that funds will continue to grow.



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NEWSLETTER

(continued from page 45)



New corporate members were welcomed to AFMA last month, at reception at the Army Navy Club in Washington. From left to right: R. T. Moore, Thiokol Chemical; Brig. Gen. T. J. Gent; R. S. Poole, National AFMA President; N. B. Weaver, Cities Service Petroleum Inc.; William Pritchard, United Shoe Machinery Corp.; C. W. Borklund, managing editor Armed Forces Management; J. R. Betzler, North American Aviation; G. S. Wheat, Republic Aviation; R. E. Cradle, American Telephone and Telegraph; B. K. Burke, Gray Mfg. Co.; J. C. Fulton, Royal McBee; VAdm. H. E. Sears (USN-ret.) Executive Director, AFMA.

Administrative Notes

To insure timely arrival of Armed Forces Management magazine to every AFMA member, a complete check of membership roll was recently made. With rapid growth of both magazine and Association in recent months, both are experiencing some "growing pains" in the matter of circulation. Chapters are urged to notify AFMA Headquarters of any discrepancies still remaining, that we may fulfill one of our most important objectives—Service to

the Membership.

Applicants wishing to take management correspondence course, "Economics of National Security" recently offered AFMA members by the Industrial College of the Armed Forces may now write directly to the college at Fort McNair, Washington, D.C. where applications will be processed. The requirements for applicants has now been broadened to include anyone with a college degree, even though below the required Rank or GS Rating of Maj/LCdr; GS 13.

Dates to Circle

April 6-7

Third annual Astronautics Symposium, Air Force Office of Scientific Research, Sheraton-Park Hotel, Washington, D.C.

April 12-18

First World Congress of Flight, combined with Air Force Association's Annual Jet Age Conference—Las Vegas, Nevada.

April 18-22

Annual meeting, American Society of Tool Engineers—Schroeder Hotel, Milwaukee, Wisc.

April 20-22

American Rocket Society, "Man-in-Space" Conference—Hotel Chamberlain, Hampton, Va.

April 30-May 1

American Rocket Society, Controllable Satellites Conference—Massachusetts Institute of Technology, Cambridge.

May 4-6

Eleventh National Aeronautical Electronics Conference—sponsored by Dayton section, Institute of Radio Engineers, Dayton, Ohio.

May 4-7

Fifth National Instrumentation Flight Test Symposium—Seattle, sponsored by the Instrument Society of America.

ARMED FORCES MANAGEMENT

45)

...NEWS IS HAPPENING AT NORTHROP



FIRST LOW-COST SPACE AGE AIRCRAFT DEMONSTRATES NORAIR SYSTEMS MANAGEMENT CAPABILITY

The twin-jet T-38—America's first supersonic trainer—aptly demonstrates Norair's capability in systems management. Now in production under USAF contract, the T-38 Talon is the first member of a Northrop-conceived family of lightweight, low-cost space age aircraft.

Soon to follow: a supersonic counterair fighter, the N-156F—first weapon system designed in America for the specific tactical and economic requirements of those free allied nations most vulnerable to enemy attack.

Other important systems management achievements include the USAF Snark SM-62A and the F-89 Scorpion. Norair management of the Snark program produced the free world's

first operational intercontinental guided missile—delivered on time and at minimum cost.

In producing America's first nuclear-armed interceptor, Norair's weapon system management of the F-89 was marked by on-time delivery of more than 1,000 units throughout the program's life, and by a significant dollar underrun. A full ten years after its first flight, the Scorpion is still the USAF's most heavily armed interceptor—and a uniquely stable platform for air-launch of atomic rockets.

Norair's cost-proved record of effective management, integrated facilities, and available resources combine to demonstrate outstanding capability as a prime systems contractor.

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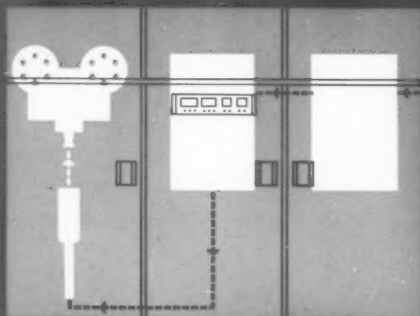
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Send for complete information concerning the S-C 4020 High-Speed Microfilm Printer. Ask for Bulletin 5-F. Write today:
Stromberg-Carlson - San Diego, 1895 Hancock Street, San Diego 12, California.

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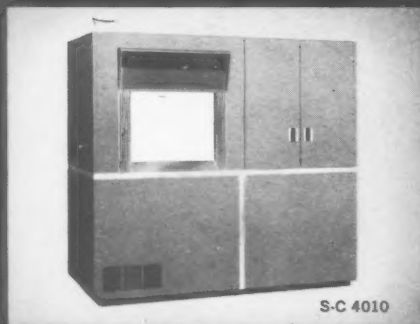
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S-C 4020

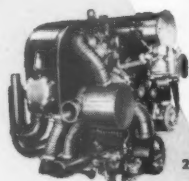


S-C 4000

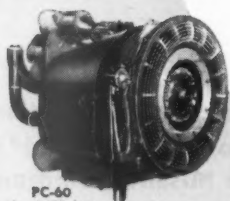


S-C 4010

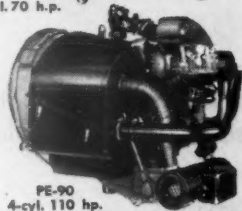
Muscles for the Missile Age!



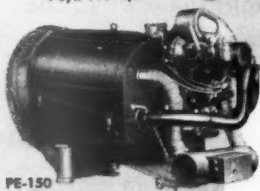
PC-30
2-cyl. 34 hp.



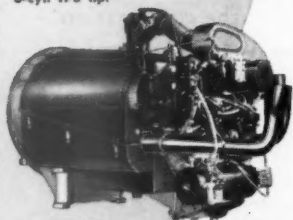
PC-60
4-cyl. 70 h.p.



PE-90
4-cyl. 110 hp.



PE-150
6-cyl. 175 hp.



PE-200
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